American Journal of Obstetrics and Gynecology

VOL. 39 APRIL, 1940 No. 4

Central Association of Obstetricians and Gynecologists

LIMITATION OF HUMAN REPRODUCTION*

THERAPEUTIC ABORTION

H. CLOSE HESSELTINE, M.D., F. L. ADAIR, M.D., AND M. W. BOYNTON, M.D., CHICAGO, ILL.

(From The University of Chicago and the Chicago Lying-in Hospital)

THERAPEUTIC abortion means the termination of an apparently normal intrauterine pregnancy before the period of viability in an effort to save or prolong the life of the mother. Between May 25, 1931, when the present institution was opened, and July 1, 1939, 134 pregnancies have been therapeutically terminated before the twenty-eighth week of gestation at the Chicago Lying-in Hospital and Dispensary. In the same period 26,131 mothers have been delivered at or near term, so that the ratio of therapeutic abortion to deliveries is 1 to 195. This figure is higher than a true cross section, for many cases were referred from outside agencies. A critical review of this material may help answer the important question, is therapeutic abortion always good therapy? Medical, and only medical, aspects are under discussion.

REVIEW OF LITERATURE

Opinions rather than data make up the bulk of the literature on therapeutic abortion. Whitehouse[21] and Redenz[17] are exceptional in reporting large series of 690 and 500 cases, respectively. Cardiac disease, gestational toxemias, pulmonary tuberculosis, and neuropsychiatric disorders constituted the major groups in which both of these workers reported therapeutic termination of pregnancies before viability.

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

Pardee[13] and Reddick[16] agree, and express more or less the opinion of most cardiologists that the presence of heart disease per se is insufficient reason for terminating a pregnancy. The degree of involvement, the cardiac response to therapy, and other factors enter into the decision for or against therapeutic abortion. Schultz[18] emphasizes that interruption of the gestation should not be undertaken while the patient is decompensated.

The problem is less urgent in most of the vascular-renal disorders, says Herrick.[8] He admits, however, that smaller groups of patients with primary nephritis are more likely to need termination before the period of viability when the nephritic symptoms do not yield to treatment.

Ingraham[10] concludes in his study of tuberculosis that the operation of therapeutic abortion is justified if the expectancy of death is in the neighborhood of 50 per cent when pregnancy is allowed to continue. On the other hand, Burrell[3, 4] advises interruption not only for active and progressive cases, but for some stationary cases as well.

Most neurologists and psychiatrists seem to believe that psychic and neurologic disorders are not absolute indications for interruption. They subscribe to the doctrine that in certain individuals intervention is the procedure of choice. Singer[19] and Cheney[5] support this stand.

Heyneman[7] and Philipp[14] point out that when impairment of kidney function occurs in an unyielding pyelitis, the pregnancy should be sacrificed.

Throughout the literature it is emphasized that every case must be evaluated upon its own merits alone.

Taussig[20] describes various operations and procedures for therapeutic abortion. Mendenhall,[11] Portis,[15] Brindeau and Lantuéjoul,[2] Haultain,[6] and Holland[9] endorse combined abdominal hysterotomy and sterilization. The use of intrauterine injections of formol as described by Boero[1] has not become popular. The use of x-ray therapy for destruction of the fetus was advocated by a few, never accepted by many, and now is in general disrepute.

Termination by dilatation and evacuation is the common practice in the first trimester of pregnancy, and properly so where ligation or resection of the tubes is not indicated. Moreover, it is almost universally agreed that therapeutic abortion should be distinctly less common after the fourth month of pregnancy.

In his discussion of therapeutic abortion, Morgan[12] calls attention to the need of adequate consultation, the importance of written consent from the husband and wife, and the merit of sterilization in properly selected cases.

DISCUSSION

The physician who terminates a pregnancy before the fetus is viable assumes a heavy responsibility. He sacrifices one life on behalf of another. In the existing medicolegal aspects of the problem the physician clearly does not have the right, even though he may have the inclination, to act on social or economic grounds. The various states have different laws relative to the legal status of therapeutic abortion, but there are no recognized indications under any existing law except those pertaining to the life or health of the mother. According to Taussig,[20] in 6 states intentional abortion is forbidden with no legal exemptions; in 38 states saving the life of the mother is recognized as the only legal exception; in 3 states and the District of Columbia preservation of health is also recognized. Therefore, whatever the indication, a therapeutic abortion should not be undertaken except for medical reasons, and only after a consultation of at least two physicians, both of whom concur in the opinion that the procedure is necessary to preserve the life or health of the mother or, rarely, to prevent

the perpetuation of serious hereditary defects. It is obvious that consultation with experts in the fields concerned is highly desirable.

The consultants should state definitely (1) whether the pregnancy should continue or be interrupted, and (2) whether future childbearing would be approved or prevented. Naturally, one should be reluctant to interrupt a pregnancy for a condition which makes childbearing hazardous and yet leave the woman exposed to the danger of further gestations or repeated abortions. On the other hand, there are various maternal disorders, such as hyperemesis gravidarum and certain types of tuberculosis, which may not in themselves constitute a bar to a future pregnancy, though they may at times be an urgent indication for termination of the current one. Likewise, there are occasional pregnant women so desperately ill as to require abortion with a minimum of trauma, and in such individuals the problem of limiting childbearing in the future may be left for later consideration.

A patient may refuse sterilization, yet agree to the termination of the pregnancy. Under such circumstances it has been our general policy to decline to interfere because of the likelihood that the problem will develop again. In our series of 134 therapeutic abortions, a sterilizing procedure was done on the mother in 90 cases, or 67 per cent, and on the husband in 3 cases, or 2 per cent; in only two cases where sterilization was recommended by the consultant but refused by the patient was a therapeutic termination carried out, and one of these individuals refused sterilization twice (Cases 2 and 3, Table IV).

DATA

Table I lists the major groups, the respective indications, and the number of sterilization operations in each.

Thoroughly adequate follow-up in our cases has not always been possible. One would like to know how the patient reacted to the interruption of her pregnancy, not only within the first weeks or months, but over a period of years. Since the majority of the terminations were done for medical rather than obstetric reasons, the patients have been followed by various clinics and specialists. Some of the patients with tuberculosis, for example, went to sanitaria; others returned to Board of Health out-patient clinics; several did not return to our own clinic for their scheduled check-up. Among the cardiac patients, the contact with the medical clinic was generally kept up over a longer period, and the same remark can be made concerning the nephritis and hypertension groups. In the whole series, 51 patients were followed for periods longer than a year; 21 for at least three years; 10 for from five to eight years.

An attempt has been made, however, to make an unbiased decision in each case as to whether, in retrospect, the procedure was wisely chosen, and whether the immediate and remote effects justified the expectation that it would improve the health and prolong the life of the mother. This impression has been recorded in the tables under the heading of "results," where the outcome is arbitrarily designated as "satisfactory" (adequate follow-up, with improvement in the patient's health attributable to the therapeutic abortion); "unchanged" (adequate or partial follow-up, with negligible improvement in the patient's health); "unsatisfactory" (procedure failed to accomplish what was intended); and "undetermined" (insufficient data for deciding on the appropriateness or effectiveness of the procedure).

TABLE I. CONDITIONS FOR WHICH THERAPEUTIC ABORTION WAS DONE

INDICATIONS	ABORTED	STERILIZED	NOT STERILIZED
Tuberculosis	32	19	13
Pulmonary	29	17	12
Other	3	2	1
Heart Disease	27	24	3
Rheumatic heart disease	25	22	3
Other	2	2	0
Nephritis	22	10	12
Chronic	19	10	9
Other	3	0	3
Other Toxemias	15	7	8
Hypertension	7	6	1
Pre-eclampsia	2	1	1
Hyperemesis	6	0	6
Neurologic and Psychiatric	20	15	5
Psychosis and psychoneurosis	10	5	5
Epilepsy	4	4	0
Multiple sclerosis	3	3	0
Other	3	3	0
Miscellaneous	18	15	3
Arthritis	5	5	0
Pyelitis and pyelonephritis	3	2	1
Blood dyscrasias	4	2	2
Diabetes	2	2	0
Fibroids	2	2	0
Other	2	2	0
Total	134	90	44

The largest group comprises patients with tuberculosis (Table II) of all types. Twenty-nine of these women had pulmonary tuberculosis; in addition, 2 had cardiac lesions, 1 had bilateral bronchiectasis, and 1 had fibroids. Three women had tuberculosis of the spine, intestines, and lymph nodes, respectively. It is significant that of the 19 women who were sterilized at the time the pregnancy was interrupted, all but 3 had at least one living child at the time of the abortion; 5 had 2; 4 had 3; 3 had 4, and 1 had 6. On the other hand, among 13 women who were aborted but not sterilized, only 4 had a living child. It is hard to escape the conclusion that strict attention to the medical problem, without reference to the number of children already in the family, might have led to different recommendations in some of these cases. Most of the patients were apparently benefited; 3 were probably not. The only technical accident in the entire series of 134 interruptions occurred in one of these 3 patients. She developed an eventration following a hysterectomy, but recovered. One patient who declined sterilization at the time of her abortion in 1935 came back pregnant in 1936 and refused interruption, carrying her fetus to delivery at term. She was sterilized the following year, and has been in fair health since.

It is well established that cardiac disease is never benefited by pregnancy, labor, and the puerperium. Some patients have considerable cardiac embarrassment, and a small number decompensate and die in the puerperium. Nevertheless, only 5 out of the 27 patients (Table III) were without living children. Rheumatic heart disease was present in 25 of the 27 cases. The results from those followed include 13 satisfactory, 2 unchanged, and 1 unsatisfactory. All but 3 were sterilized (one of these refused). In contrast to the fact that no fatalities occurred in this series of women with severe cardiac lesions, 8 deaths resulted in the same period among patients with heart disease who carried a pregnancy to viability. Surely then therapeutic abortion rendered a valuable service by shielding the heart from a heavier burden and at the same time prolonging the

TABLE II. THERAPEUTIC ABORTION IN 32 CASES OF TUBERCULOSIS

NO.	UNIT NO.	AGE	GRAV.	LIVING CHILD.	DIAGNOSIS	WEEKS PREGNANT	TERMINATION	STERIL.	RESULTS
1	115152	20	i	0	Tuberc., pulmon.	6	D & C	No	Unchanged
2	91089	21	ii	1	Tuberc., pulmon.	12	D & C	No	Satisf. Term deliv. later
3	183128	23	i	0	Tuberc., pulmon.	8	D & C	No	Satisf. Term deliv. later
4	199278	23	ii	1	Tuberc., pulmon.	8	D & C	No	Undetermined
5	74303	23	ii	1	Tuberc., pulmon.	8	D & C	No	Undetermined
6	51888	24	i	0	Tuberc., pulmon.	6	D & C	No	Satisfactory
7	62230	24	i	0	Tuberc., pulmon.	8	D & C	No	Unchanged
8	2818	29	v	2	Tuberc., pulmon.	6	D & C	No	Satisfactory
9	117606	29	ii	0	Tuberc., pulmon.	12	D & C	No	Undetermined
10	126718		ii	0	Tuberc., pulmon.	10	D & C	No	Undetermined
11	160053	25	i	0	Tuberc., pulmon.	16	Bag induct. & embry.	No	Unsatisfactory
12	111644	21	v	0	Tuberc., pulmon. Bronchiect.	12	Abd. hysterot.	Yes	Unchanged
13	172584	22	vi	4	Tuberc., pulmon. R.H.D.*	12	Abd. hysterot.	Yes	Undetermined
14	87569	26	ii	1	Tuberc., pulmon.	14	Abd. hysterot.	Yes	Unchanged
15	53323	27	iii	2	Tuberc., pulmon.	10	Abd. hysterot.	Yes	Undetermined
16	163698	28	xi	0	Tuberc., pulmon.	12	Abd. hysterot.	No	Undetermined
17	89994	30	vi	2	Tuberc., pulmon.	14	Abd. hysterot.	Yes	Satisfactory
18	44884	31	vii	3	Tuberc., pulmon.	11	Abd. hysterot.	Yes	Undetermined
19	67838	32	vii	6	Tuberc., pulmon. R.H.D.	12	Abd. hysterot.	Yes	Undetermined
20	123909	34	viii	3	Tuberc., pulmon.	14	Abd. hysterot.	Yes	Satisfactory
21	128294	35	i	0	Tuberc., pulmon.		Abd. hysterot.	Yes	Undetermined
22	135893	36	ii	0	Tuberc., pulmon.	8	Abd. hysterot.	Yes	Unsatisfactory
23	145045	40	ii	Twins	Tuberc., pulmon.	16	Abd. hysterot.	Yes	Unchanged
24	149491	40	v	4	Tuberc., pulmon.	9	Abd. hysterot.	Yes	Satisfactory
25	128644	43	vi	3	Tuberc., pulmon.	16	Abd. hysterot.	Yes	Unchanged
26	83109		iv	3	Tuberc., pulmon.	17	Abd. hysterot.	Yes	Undetermined
27	58116	29	iii	1	Tuberc., pulmon.	14	Abd. hysterect.	Yes	Satisfactory
28	111639	34	vi	4	Tuberc., pulmon. Fibroid	12	Abd. hysterect.	Yes	Undetermined
29	141204	39	v	2	Tuberc., pulmon.	6	Abd. hysterect.	Yes	Unchg. Evisceration
30	117364	22	i	0	Tuberc., intest.	6	D & C	No	Undetermined
31	41238	20	ii	1	Tuberc., vert. ment. defect.	10	Abd. hysterot.	Yes	Satisfactory
32	79710	29	iv	2	Tuberc., lymphat.	10	Abd. hysterot.	Yes	Satisfactory

*R.H.D., rheumatic heart disease; D. & C., dilatation and curettage.

TABLE III. THERAPEUTIC ABORTION IN 27 CASES OF HEART DISEASE

NO.	UNIT NO.	AGE	GRAV.	LIVING CHILD.	DIAGNOSIS	WEEKS PREGNANT	TERMINATION	STERIL.	RESULTS
1	74280	23	i	0	R.H.D.* Mit. & aort. insuf. & sten.	10	D & C*	No	Undetermined
2	181401	25	ii	0	R.H.D. Mit. & aort. insuf.	8	D & C	No	Undetermined
3	63319	30	iv	1	R.H.D. Mit. sten.	6	D & C	No	Undetermined
4	60621	18	ii	0	R.H.D. Mit. sten.	12	Abd. hysterot.	Yes	Undetermined
5	70412	21	iii	2	R.H.D. Mit. & aort. insuf.	6	Abd. hysterot.	Yes	Undetermined
6	109353	22	iii	2	R.H.D. Mit. sten.	16	Abd. hysterot.	Yes	Undetermined
7	45955	24	iv	2	R.H.D. Mit. sten. & insuf.	16	Abd. hysterot.	Yes	Satisf., prev. ces. sec.
8	80861	25	ii	1	R.H.D. Mit. sten. & insuf.	12	Abd. hysterot.	Yes	Satisfactory
9	24818	25	iii	2	R.H.D. Mit. sten. & insuf.	12	Abd. hysterot.	Yes	Satisfactory
10	188836	26	ii	1	R.H.D. Mit. sten. & insuf.	14	Abd. hysterot.	Yes	Satisfactory
11	121844	27	iii	2	R.H.D.	10	Abd. hysterot.	Yes	Satisf., prev. ces. sec.
12	129181	28	i	0	R.H.D.	12	Abd. hysterot.	Yes	Satisfactory
13	75091	28	iv	2	R.H.D. Mit. stenosis	11	Abd. hysterot.	Yes	Undetermined
14	64157	29	iv	2	R.H.D. Mit. stenosis & insuf.	12	Abd. hysterot.	Yes	Satisfactory
15	80130	29	iii	2	R.H.D. Mit. stenosis prev. decomp.	22	Abd. hysterot.	Yes	Satisfactory
16	50187	30	ii	1	R.H.D. Mit. stenosis & insuf. decomp.	10	Abd. hysterot.	Yes	Satisfactory
17	136490	31	iii	2	R.H.D.	17	Abd. hysterot.	Yes	Unsatisf., prev. ces. sec.
18	99028	33	viii	2	R.H.D. Mit. insuf.	16	Abd. hysterot.	Yes	Undetermined
19	153606	34	vi	2	R.H.D. Mit. sten. vascul. renal d.	10	Abd. hysterot.	Yes	Undetermined
20	107894	38	iii	1	R.H.D. Mit. sten.	16	Abd. hysterot.	Yes	Unchanged
21	159341	38	v	4	R.H.D. Mit. sten. & insuf.	9	Abd. hysterot.	Yes	Satisfactory
22	46278	25	iii	2	R.H.D. Mit. sten. prev. decomp.	12	Abd. hysterot.	Yes	Satisfactory
23	46278	26	iv	2	R.H.D. Mit. sten. prev. decomp.	24	Abd. hysterect.	Yes	Satisfactory
24	99382	33	viii	4	R.H.D. Mit. sten. prev. decomp.	6	Abd. hysterect.	Yes	Unchanged
25	38927	35	xiii	5	R.H.D. Mit.	8	Abd. hysterect.	Yes	Satisfactory
26	133261	21	i	0	Myocarditis, aortic insuf.	12	Abd. hysterect.	Yes	Undetermined
27	105821	25	iii	2	Myocarditis, coaretation aorta	12	Abd. hysterot.	Yes	Undetermined

*R.H.D., rheumatic heart disease; D & C, dilatation and curettage.

TABLE IV. THERAPEUTIC ABORTION IN 22 CASES OF NEPHRITIS

NO.	UNIT NO.	AGE	GRAV.	LIVING CHILD.	DIAGNOSIS	WEEKS PREGNANT	TERMINATION	STERIL.	RESULTS
1	54752	18	ii	1	Chr. nephritis	8	D & C	No	Undetermined
2	89797	20	i	0	Acute nephritis	22	Gauze induct. embry.	No	Unchanged
3	89797	23	ii	0	Chr. nephritis	8	D & C	No	Unchanged
4	126939	20	i	0	Subacute nephritis	18	D & C & embry.	No	Unchanged
5	143071	33	x	3	Chr. nephritis, hyperten.	6	D & C	No	Undetermined
6	64538	34	iv	2	Chr. nephritis	6	D & C	No	Undetermined
7	47832	36	ix	?	Chr. nephritis	8	D & C	No	Unsatisf., died 7 mo.
8	107854	40	iii	2	Chr. nephritis	8	D & C	No	Satisfactory
9	71202	42	iv	2	Chr. nephritis	8	D & C	No	Undetermined
10	127581	20	i	0	Subacute nephritis	16	Vag. hysterect. & embry.	No	Unchg., died 2½ yr.
11	156261	20	i	0	Chr. nephritis	21	Vag. hysterect.	No	Unsatisf., died 1 yr.
12	68801	36	v	0	Chr. nephritis	26	Vag. hysterect. & embry.	No	Undetermined
13	138958	20	iii	2	Chr. nephritis	10	Abd. hysterot.	Yes	Undetermined
14	93989	21	iii	0	Chr. nephritis	24	Abd. hysterot.	Yes	Satisfactory
15	161815	23	ii	1	Chr. nephritis, hyperthyr.	14	Abd. hysterot.	Yes	Satisfactory
16	39070	31	v	2	Chr. nephritis	10	Abd. hysterot.	Yes	Satisfactory
17	180480	33	xi	9	Chr. nephritis	24	Abd. hysterot.	Yes	Undetermined
18	121529	34	ii	0	Chr. nephritis, fibroids	14	Abd. hysterot. & myomect.	Yes	Unchanged
19	59559	34	viii	3	Chr. nephritis	16	Abd. hysterot.	Yes	Satisfactory
20	51010	36	v	4	Chr. nephritis, hyperthyr.	24	Abd. hysterot.	Yes	Satisfactory
21	114323	42	vii	5	Chr. nephritis	20	Abd. hysterect.	Yes	Undetermined
22	83430	43	xvi	13	Chr. nephritis	12	Abd. hysterect.	Yes	Unchanged

TABLE V. THERAPEUTIC ABORTION IN 15 CASES OF HYPERTENSION, PRE-ECLAMPSIA AND HYPEREMESIS

NO.	UNIT NO.	AGE	GRAV.	LIVING CHILD.	DIAGNOSIS	WEEKS PREGNANT	TERMINATION	STERIL.	RESULTS
1	46402		viii	0	Hyperten., obesity	8	D & C*	No	Satisfactory
2	130528	23	ii	0	Hyperten., C.N.S.* syphilis	12	Abd. hysterot.	Yes	Undetermined
3	91383	24	ii	1	Hyperten.	6	Abd. hysterot.	Yes	Undetermined
4	193754	34	iii	2	Hyperten.	13	Abd. hysterot.	Yes	Satisfactory
5	173033	35	vii	0	Hyperten., fibroids	18	Abd. hysterect.	Yes	Unchanged
6	58806	36	ii	1	Hyperten.	10	Abd. hysterect.	Yes	Unchanged
7	133775	42	v	4	Hyperten.	17	Abd. hysterect.	Yes	Unchanged
8	142389	25	i	0	Pre-eclampsia	22	Vag. hysterot. & embryot.	No	Satisfactory
9	143069	37	iv	3	Pre-eclampsia	10	Vag. hysterect.	Yes	Unchanged
10	195680	23	ii	0	Hyperemesis	8	D & C	No	Satisfactory
11	117960	25	iii	1	Hyperemesis	12	D & C	No	Satisf. Term preg. later
12	63614	29	ii	1	Hyperemesis, hyperthyr.	10	D & C	No	Undetermined
13	5007	34	ii	1	Hyperemesis	10	D & C	No	Satisfactory
14	121850	32	iii	1	Hyperemesis	14	Vag. hysterot.	No	Unsatisf. Died 33 hr.
15	145144	23	i	0	Hyperemesis	20	Vag. hysterot.	No	Satisfactory

*C.N.S., central nervous system; D & C, dilatation and curettage.

TABLE VI. THERAPEUTIC ABORTION IN 20 CASES OF NEUROLOGIC AND PSYCHIATRIC DISEASES

NO.	UNIT NO.	AGE	GRAV.	LIVING CHILD.	DIAGNOSIS	WEEKS PREGNANT	TERMINATION	STERIL.*	RESULTS
1	189310	34	v	3	Psychosis, hyperemesis	7	D & C	No H	Undetermined
2	135285	35	iii	2	Psychosis	10	D & C	No H	Undetermined
3	51096	38	ii	0	Psychosis familial (husband)	7	D & C	No H	Undetermined
4	100903	26	ii	1	Psychosis, hyperemesis	26	Vag. hysterot.	No	Undetermined
5	210908	31	iii	2	Psychosis, syphilis	12	Abd. hysterot.	Yes	Unchanged
6	107065	32	iv	2	Psychosis, hyperemesis	14	Abd. hysterot.	Yes	Undetermined
7	188891	27	iii	2	Psychosis (post partum twice)	16	Abd. hysterect.	Yes	Satisfactory
8	99791	32	iii	2	Psychoneurosis, hyperemesis	10	D & C	No	Undetermined
9	48434	31	ii	0	Psychoneurosis	8	Abd. hysterot.	Yes	Satisfactory
10	3004	37	vi	5	Psychoneurosis	10	Abd. hysterot.	Yes	Satisfactory
11	73754	20	ii	1	Epilepsy	14	Abd. hysterot.	Yes	Unsatisfactory
12	145315	23	i	0	Epilepsy	12	Abd. hysterot.	Yes	Unchanged
13	79284	27	ii	1	Epilepsy	22	Abd. hysterot.	Yes	Unchanged
14	115826	31	ii	1	Epilepsy	12	Abd. hysterect.	Yes	Undetermined
15	46438	24	ii	1	Multiple sclerosis	14	Abd. hysterot.	Yes	Undetermined
16	127905	26	iii	1	Multiple sclerosis	8	Abd. hysterot.	Yes	Undetermined
17	99905	32	iv	3	Multiple sclerosis	12	Abd. hysterot.	Yes	Unchanged
18	35859	40	iii	2	Otosclerosis	10	Abd. hysterot.	Yes	Unchanged
19	166611	28	iii	2	Meningoencephalitis	12	Abd. hysterot.	Yes	Undetermined
20	48654	34	viii	2	Pituitary tumor, acromegaly	12	Abd. hysterot.	Yes	Unchanged

*No H, husband only sterilized.

TABLE VII. THERAPEUTIC ABORTION IN 18 CASES OF MISCELLANEOUS DISORDERS

NO.	UNIT NO.	AGE	GRAV.	LIVING CHILD.	DIAGNOSIS	WEEKS PREGNANT	TERMINATION	STERIL.	RESULTS
1	23004	29	ii	1	Arthritis deformans, R.H.D.	8	Abd. hysterot.	Yes	Unchanged
2	42889	29	iii	2	Arthritis deformans	8	Abd. hysterect.	Yes	Undetermined
3	93997	34	iv	2	Arthritis deformans	7	Abd. hysterect.	Yes	Undetermined
4	86487	39	ii	1	Arthritis deformans	8	Abd. hysterect.	Yes	Undetermined
5	20354	39	iii	2	Sacroiliac arthritis	12	Abd. hysterect.	Yes	Satisfactory
6	75446	28	iii	1	Pyelitis	6	D & C	No	Undetermined
7	84884	35	iv	2	Pyelitis, hydronephrosis	7	Abd. hysterot.	Yes	Satisfactory
8	142382	20	ii	1	Pyelonephritis	12	Abd. hysterot.	Yes	Unchanged
9	1312	34	i	0	Diabetes mellitus, fibroids	10	Abd. hysterect.	Yes	Unchanged
10	177505	36	iii	1	Diabetes mellitus	12	Abd. hysterot.	Yes	Undetermined
11	122963	33	ii	1	Purpura, hyperemesis	6	D & C	No	Undetermined
12	43089	24	iv	2	Purpura	17	Abd. hysterect.	Yes	Undetermined
13	71865	41	vi	5	Anemia, secondary unresponsive	10	D & C	No	Undetermined
14	59215	26	ix	6	Hodgkins' dis., failed x-ray steril.	18	Abd. hysterot.	Yes	Unchanged
15	69839	34	i	0	Uterine fibroid, choc. cyst	10	Abd. hysterect.	Yes	Undetermined
16	111614	37	i	0	Uterine fibroid	8	Abd. hysterect.	Yes	Undetermined
17	39680	30	ix	6	Arsenical hepatitis, syphilis	10	Abd. hysterot.	Yes	Satisfactory
18	64133	28	iii	2	Bronchiectasis	14	Abd. hysterot.	Yes	Unchanged

patient's life. Termination of pregnancy before viability is indicated only when response to therapy and management fail to arrest the downward course of the heart disease or when there is inadequate response to therapy in the advanced stages.

That pregnancy and nephritis are often incompatible has long been established (Table IV). Only 13 of 22 nephritic patients were known to have living children. Twelve of the 22 were not sterilized because of the poor prognosis for life and the unlikelihood of subsequent gestations. Termination of pregnancy was of value in removing the additional burden upon the vascular and renal systems. Two patients appear not to have benefited, 9 were not followed, 6 had a satisfactory response, and 5 remained unchanged.

Among 7 hypertension patients (Table V), 2 had no follow-up, 2 were benefited, and 3 remained unchanged. One of the 2 pre-eclamptic patients had a persistent hypertension, while the other one apparently was free from residual damage. The only immediate fatality in the entire series of 134 cases occurred in the hyperemesis group. This patient had been under care elsewhere for almost three months. Her condition was critical on admission, and supportive treatment was unavailing. The termination was undertaken even though the outlook was grave, as all other measures had failed. She died thirty-three hours after the operation. Of the other patients, one did not return and the remaining 4 had completely satisfactory results. One patient went through pregnancy and normal labor subsequently.

The neurologic and psychiatric disorders (Table VI) comprise 7 psychoses, 3 psychoneuroses, 4 epilepsies, 3 multiple scleroses, and one each of otosclerosis, meningoencephalitis, and pituitary tumor. Sterilization operations were performed on 15 patients and on the husbands of 3 others. The ultimate results are undetermined in 10, unchanged in 6, satisfactory in 3, and unsatisfactory in 1. The six patients whose condition is classified as unchanged probably derived benefit from the interruption; the complicating disorder at least did not progress as rapidly as it might have in the presence of the continuing pregnancy. Case 3 indicated a problem in which insanity has been transmitted directly and consecutively through at least 3 generations of the husband's family. The outlook for this child on a basis of his family tree was indeed tragic.

Table VII presents a group of miscellaneous disorders. The fact that only 3 patients with pyelitis and 2 with diabetes required therapeutic abortion indicated the infrequency of the procedure in such conditions. The 5 cases of arthritis were interrupted because the disease progressed distinctly more rapidly during pregnancy.

SUMMARY

In retrospect, it appears that all of the terminations were undertaken after adequate observation and thorough consideration. In spite of this caution, certain of the abortions failed to give the expected benefit, and did not relieve the underlying disorder. In a few cases the interruptions were probably delayed too long. On the whole, it seems clear that considerably more good was accomplished than is indicated by the arbitrary designations in the result columns.

A number of conclusions may be drawn:

1. Therapeutic abortion is a necessary, but relatively infrequent, obstetric procedure.

2. It should be done only to save or to prolong significantly the life of the mother, or to prevent the transmission of serious hereditary defects.

3. It should be attempted only after adequate consultation, only in reputable hospitals, only by competent operators, and only after both the husband and wife (or legal guardian) consent.

4. It is rarely, if ever, an emergency procedure, and should not be undertaken until the patient is in the best possible condition for it.

5. It is not without some risk of operative complications, and even fatality.

6. Sterilization is indicated whenever the same problem would arise in a subsequent pregnancy.

REFERENCES

(1) *Boero, E. A.:* Gynéc. et obst. **32:** 502, 1933. (2) *Brindeau, A., and Lantuéjoul, P.:* Ibid. **32:** 55, 1935. (3) *Burrell, L. S. T.:* Proc. Roy. Soc. Med. **25:** 1, 1931. (4) *Idem:* Ibid. **25:** 247, 1931. (5) *Cheney, C. O.:* J. A. M. A. **103:** 1914, 1934. (6) *Haultain, W. F. T.:* Edinburgh Obst. Soc. Trans. **89:** 90, 173, 1929-1931. (7) *Heyneman, T.:* Zentralbl. f. Gynäk. **62:** 2811, 1938. (8) *Herrick, W. W.:* J. A. M. A. **103:** 1902, 1934. (9) *Holland, E.:* Proc. Roy. Soc. Med. **26:** 262, 1933. (10) *Ingraham, C. B.:* Am. J. Obst. & Gynec. **23:** 1, 1932. (11) *Mendenhall, A. M.:* Ibid. **23:** 67, 1932. (12) *Morgan, H. S.:* Neb. State Med. J. **18:** 95, 1933. (13) *Pardee, H. E. B.:* J. A. M. A. **103:** 1899, 1934. (14) *Philipp, E.:* Zentralbl. f. Gynäk. **61:** 2549, 1937. (15) *Portis, L.:* Gynéc. et obst. **20:** 46, 1929. (16) *Reddick, W. G.:* Texas State J. Med. **31:** 556, 1936. (17) *Redenz, E.:* Med. klin. **32:** 1359, 1936. (18) *Schultz, W.:* Arch. f. Gynäk. **166:** 62, 1938. (19) *Singer, H. D.:* J. A. M. A. **91:** 2042, 1928. (20) *Taussig, F. J.:* Abortion; Spontaneous and Induced, Medical and Social Aspects, St. Louis, 1936, The C. V. Mosby Co. (21) *Whitehouse, B.:* Brit. M. J. **2:** 337, 1932.

DISCUSSION

DR. JOHN H. MOORE, Grand Forks, N. D.—Our series of 19 therapeutic abortions was done for the following conditions: nephritis, 6 cases; hydronephrosis, 1 case; pulmonary tuberculosis, 4 cases; hyperemesis gravidarum, 3 cases; hypertension, 2 cases; mitral stenosis, 1 case; gestational psychosis, 1 case; myomatous uterus, 1 case.

I am fully in accord with Dr. Hesseltine's statement that medical indications *only* should indicate the performance of therapeutic abortion and then only after competent and careful consultation, when all other therapy has failed.

In our 19 therapeutic abortions, hysterotomy and sterilization was done in 11; subtotal abdominal hysterectomy in 1 and dilatation and curettage in 7. In 2 of the patients upon whom dilatation and curettage was employed, we had recommended hysterotomy and sterilization, but permission was refused. Thus there were 14 of the 19 patients whose medical condition was such that we believed future childbearing would be hazardous to life. In other words, 73 per cent of this series required sterilization as well as therapeutic abortion. The actual percentage sterilized was 63 per cent.

In our series there was only one primiparous patient, an advanced case of pulmonary tuberculosis with marked cavitation; all of the other patients had from 2 to 7 living children with the exception of one of the patients with hypertension, who had had a therapeutic abortion elsewhere by dilatation and curettage in her first pregnancy.

What is the salvage rate in patients upon whom therapeutic abortion is done? While there was no mortality from the surgical procedures in my series, a follow-up of these 19 patients has shown that 4 of them died from two to five years after the therapeutic abortion from the medical condition which indicated the abortion, a delayed mortality of 22 per cent. Two of the remaining, living patients are hopeless invalids.

The problem of therapeutic abortion is a medical one. We should not be led astray by a confusion of religious, sociologic or economic reasons for or against it. The medical conditions present in any case where this operation is under serious consideration will be sufficient to tax all of our diagnostic, prognostic, and therapeutic abilities.

DR. M. W. SEARIGHT, MEMPHIS, TENN.—We have worked out a plan for a rapid sterilization. A transverse incision is made, 4 cm. long and 6 cm. above the symphysis pubis. With the patient in the Trendelenburg position a ribbon retractor is run into the cul-de-sac. The assistant pushes against the cervix and the uterus is brought into the small opening. Sterilization can be carried out without danger, and you can suspend the uterus at the same time if it is necessary. These patients are able to leave the hospital in five days. We have had no complication following this operation. It is much quicker than the vaginal route, and there is no stretching of the ligaments as occurs after the vaginal operation.

DR. ALBERT E. CATHERWOOD, DETROIT, MICH.—Michigan is one of 38 states in which the indication for therapeutic abortion is solely that of saving the life of the mother. Formerly it was not difficult for any one who wanted to do a therapeutic abortion to get one or two doctors to agree with him.

We have set up a permanent therapeutic abortion committee in the Harper Hospital which considers all cases in which therapeutic abortion may be indicated. The case is thoroughly studied and presented by the man who has worked it up. The committee then considers what action should be taken, not only whether or not therapeutic abortion should be done but also the question of sterilization. We think it a very satisfactory method, and have noted that since the appointment of this permanent committee, the number of therapeutic abortions in Harper Hospital has been greatly reduced.

DR. FREDERICK H. FALLS, CHICAGO, ILL.—To the Research Hospital of the University of Illinois a good many patients are sent by the Chicago Municipal Tuberculosis Sanitarium staff for therapeutic abortion. We do not as a rule accept the judgment of those men who have had a good deal of special training in tuberculosis unless the medical consultants in the University of Illinois agree with them. Williams showed that those patients that were aborted from his clinic did worse than those that were not aborted.

I doubt very much whether psychosis is ever an indication for abortion. The psychosis that occurs in pregnancy is not due to the pregnancy. The pregnancy is only the straw that breaks the camel's back, and the pregnant woman who is psychotic will not be helped by abortion. The baby has a right to its existence and should have its chance. The possibility of its being psychotic is not 100 per cent by any means.

Vaginal sterilization is a very valuable way of sterilizing women whom the medical complication makes poor surgical risks. This can be done under local anesthesia up to the third or fourth month. I believe that is the best way to do it.

DR. ROBERT M. GRIER, EVANSTON, ILL.—It has been the experience of Dr. Don Sutton in his large heart clinic at the Cook County Hospital, where he has handled and followed many women with rheumatic heart disease during pregnancy, that this condition is rarely ever an indication for therapeutic abortion. He and others recently reported a large series of patients who were carried through pregnancy and labor, with but one death. Many of these women were decompensated at some time during their pregnancy but with proper management were able to be made to compensate before delivery.

DR. HESSELTINE (closing).—The therapeutic abortion committee mentioned by Dr. Catherwood is a very good idea. It would give moral support and medicolegal protection to the institution and to the individuals responsible.

Dr. Grier brought out a very good point about heart disease. We did not have a single fatality in a fairly large series of 27 cases. These were not mild cases, but practically all had decompensation or well-advanced heart disease.

It is well to remember that in certain diseased conditions the fetus may suffer appreciably. That is not a direct indication, but it does enter into consideration. At the same time there may be severe damage to the mother, as for instance in nephritis.

A STUDY OF THE POSSIBLE SIGNIFICANCE OF THE VAGINAL SMEAR AS AN ADDITIONAL FACTOR IN THE DIAGNOSIS OF INCOMPLETE ABORTION*

PAUL F. FLETCHER, M.D., M.O.G., ST. LOUIS, MO.

(From the Department of Obstetrics and Gynecology, St. Louis University School of Medicine)

HUMAN vaginal smears have been used for many years in the study of various conditions but their application to morphologic and physiologic studies had been extremely limited until the last twelve or fifteen years. The role, if any, that the vaginal smear is to play as a diagnostic help in clinical medicine has only been suggested and that by not more than three investigators to date. The work done so far enables us to test the adaptability and significance of the vaginal smear as a useful clinical procedure. The object of this work has been to study the vaginal smear and its possible significance as an additional factor in the diagnosis of incomplete abortion, and to develop a staining technique that is sufficiently simple to be applicable to office and clinic use.

REVIEW OF LITERATURE

Dierks tried to show that in the human female a definite cycle takes place in the vagina. At the height of the change the epithelium is composed of three layers: a basal or deep, a functional or superficial, and an intra-epithelial or cornified layer situated between the first two. Adler agreed with Dierks after finding evidence of three layers to be most marked during the premenstrual period. He further pointed out the presence of an exceedingly well-developed functional layer in early pregnancy. He found no evidence of a functional layer in the postpartum period, during lactation, after the menopause and before puberty. This fact strengthens the belief in a vaginal cycle and tends to corroborate the contention of Dierks, that the vaginal cycle keeps pace with the cycle of the uterus and ovary.

In 1925, Papanicolaou announced in a preliminary report some of the results of his early human vaginal smear studies. He maintained that pregnancy, among other things, affects the entire genital tract, including the vagina, in a way which produces definite and typical changes in the consistency and make up of the vaginal smear.

Kelly, in developing a technique for the diagnosis of pregnancy in the guinea pig by a study of the vaginal epithelium, observed that certain changes are quite marked. They begin to develop in the second week and are well developed by the end of the third week. These changes may persist for at least two or three weeks following delivery estrus.

After a study of large numbers of vaginal smears from different mammals, Papanicolaou states that he has been led to realize that pregnancy, as well as different pathologic conditions of the ovaries and genital tract, might be diagnosed more or less accurately by an analysis of such smears. The entire composition of the vaginal smear changes rather typically under different conditions.

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2, 1939.

The occurrence of pregnancy may be definitely recognized by certain typical changes in the structure of the smear. The prevailing types of desquamated cells show a deviation from the usual types. Soon after the beginning of pregnancy there is a distinct tendency for cells to assume certain characteristic forms. These forms may appear, occasionally, in other conditions normal or otherwise but are not so typical or as consistent as in the pregnancy smear.

Papanicolaou says, "The approach or occurrence of parturition, abortion or resorption may *possibly be* revealed by certain smear changes. As soon as delivery or abortion takes place and the corpus luteum begins to regress, the smear presents an entirely different appearance indicating the onset of active destructive processes." He believes that as a whole the study of the vaginal smear seems to be of important diagnostic value and may be a useful adjunct in gynecology in the diagnosis of certain doubtful cases.

VAGINAL SMEARS IN ABORTIONS

With this in mind and aware of the frequency with which the gynecologist is confronted with patients whose chief complaint is abnormal vaginal bleeding, and because incomplete abortion is generally recognized as the most common cause of this bleeding, it was decided to undertake this investigation to see whether or not a vaginal smear procedure sufficiently simple to be applicable for clinic or office use, might be recognized or developed; moreover if its dependability could be established to a degree of satisfaction that would warrant the general recognition of the vaginal smear as a useful adjunct in the diagnosis of incomplete abortion.

THE HISTOMORPHOLOGY OF THE VAGINAL EPITHELIUM AS THE BASIS OF THE VAGINAL SMEAR

In order to explain the probable source of origin of cells that characterize the smear of incomplete abortion, a discussion of the histologic aspects of the vaginal mucous membrane is essential.

The reason for the presence of cells in the vaginal smear has been very satisfactorily explained by Papanicolaou.[16] He says: "Most of the cells found in the vaginal smear are derived from the superficial layers of the vaginal epithelium. These cells are subject to continuous desquamation and are constantly present in the vaginal canal. Cells of the deeper layers are less frequently thrown off and appear in large quantities only when active denudation follows periods of excessive growth. This occurs in humans after parturition."

Stieve found a marked increase in the height of the vaginal epithelium in the premenstrual phase of the human menstrual cycle, but this is not as extensive as the increase which occurs during the first months of gestation. The proliferation taking place in early pregnancy is from the basal, or germinative, layer. It results in a gradual increase in the number of epithelial cells and cell layers. The cells themselves and their nuclei are noticeably increased in size. After the onset of parturition, degenerative changes set in and result in an extensive desquamation of all cellular excess.

Smith studied this problem on sections taken at autopsy. He also noted and described three layers in the vaginal mucosa. Because of its completeness and relative simplicity, his description has been chosen as a part of this paper. It has been, for the most part, the histologic basis upon which our study of the contents of the vaginal mucosa has been made. We have also taken into consideration the additional division of the basal layer as described by Papanicolaou (Fig. 1).

Smith describes the outer layer or superficial zone as made up of squamous cells containing small dark-staining nuclei and clear-staining cytoplasm. They are flat, elliptical or elongated and are several layers thick.

The middle layer called the intraepithelial or cornified zone is differentiated from the outer by slightly expanded pale cells that vary somewhat in size but are definitely larger and paler staining. They undergo cornification changes which are manifest by a marked cellular flattening and the development of pyknotic nuclei.

The deep layer or basal zone is composed of a basement membrane made up of two or three layers of dark-staining cells, having darker-staining nuclei and relatively little cytoplasm. Immediately above this are located several layers of increasingly larger cells whose size is due to an increase in the amount of cytoplasm. They tend toward the round, elliptical and cuboidal forms and as they

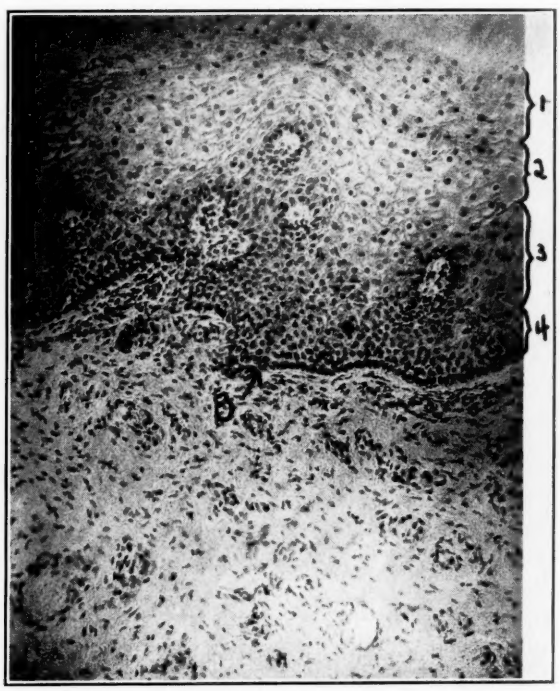

Fig. 1.—Normal vaginal epithelium (courtesy of Dr. M. A. Roblee). *1*, Superficial zone; *2*, intraepithelial zone; *3*, outer basal zone; *4*, inner basal zone; *B*, basement membrane.

approach the intraepithelial and superficial layers they begin to flatten out consistently. This tendency is not quite as marked, however, as in the cells of the more superficial layers. They are consistently smaller in size. This feature makes identification of this layer relatively easy.

Papanicolaou recognizes these epithelial zones but feels that while a study of the vaginal mucosa in sections does not justify a division of the basal layer into an inner and outer basal zone, a study of the cells themselves as found in the vaginal smear warrants this further division into an inner basal or germinative zone and an outer basal or pavement cell zone. The necessity for this is the fact that during the post-partum period cells corresponding to those from a well-differentiated outer basal, or pavement cell zone, appear in abundance.

So far as we have been able to determine, this particular type of cell (pavement cell) does not characterize any other type of gynecologic

condition. *Since they abound in the average post-partum smear, it seemed reasonable to us to assume that their presence in vaginal smears taken from women suspected of having an incomplete abortion, might be acceptable as a diagnostic feature of this condition.* Hence, part of our endeavor has been to try to determine whether or not the absence of pavement cells in these smears can be depended upon to rule out the possibility of incomplete abortion in cases of excessive vaginal bleeding.

VAGINAL SMEAR CHANGES IN PREGNANCY AND AFTER PARTURITION AS COMPARED TO THOSE NOTED IN CASES OF INCOMPLETE ABORTION

Pregnancy is characterized by extensive growth and secretory phenomena in the corpus luteum and uterus. These activities correspond to those taking place in the premenstrual phase of a normal menstrual cycle but are much more pronounced.

Stieve has described the morphologic changes taking place in the human vaginal epithelium during pregnancy. He says, the termination of pregnancy results in a very pronounced destructive phenomenon and that with the onset of parturition the vaginal epithelium undergoes extensive denudation. We have found both gross and microscopic evidence of the same activity. The majority of cells found in vaginal smears taken post-partum substantiate this condition. They are apparently derived from the deeper outer basal zone, and usually show a compact round or oval form or may be navicular in shape. The nucleus is large, slightly oval and often displaced to one side, or may show vacuoles around it. We looked for these cells in all smears taken from patients suspected of having an incomplete abortion that came under our care on the Gynecological Service of Firmin DesLoge Hospital for a period of two years.

PLAN OF PROCEDURE

Daily vaginal smears were taken from every patient entering the hospital with a tentative diagnosis of incomplete abortion and also from those in whom this possibility could not be definitely ruled out. This was continued until the patient was curetted. Twenty-four hours after operation daily "smearing" was resumed, using strict aseptic precautions and continued until the patient left the hospital. No difficulties or complications were encountered in this practice.

Smears were taken at regular intervals from pregnancy cases in various stages of development, usually weekly or bimonthly, and were continued on individual cases as long as it was possible to contact them in the prenatal clinic. These periods varied from one to seven months. Contacts were established in some instances as early as the tenth week and in others from the sixteenth to the thirty-third week. Whenever possible, contacts started late in pregnancy were maintained until the patient entered the hospital for delivery, and then were continued throughout the first two weeks post partum.

A large series of vaginal smears were taken at random from prenatal cases at practically all periods of gestation. The number of days since the beginning of pregnancy was noted on each slide. The same was done on post-partum cases during the first two weeks of the puerperium, and in four cases this was again resumed after the sixth week and continued at weekly intervals for three to seven weeks more.

A series of vaginal smear specimens composed of daily smears taken from normal individuals for one, two, and three consecutive menstrual cycles were

available for study and comparison. These were prepared for a study of another phase of the vaginal smear problem. In one of these cases conception took place about the middle of the second month and daily smears were continued for the next three weeks.

Each of these series was first studied separately and individual characteristics noted. Then comparisons with our slides were made. They were carefully studied and worked out in an endeavor to recognize any morphologic characteristics that might consistently identify the vaginal smear of incomplete abortion.

In the collection of these slides care was taken to make three or four each time so as to have available practically identical smears for staining with the various types of procedures used.

For controls, smears taken during the premenstrual and menstrual phases of apparently normal cycles were used; also, those prepared from all pregnancy and post-partum cases studied in this series.

DESCRIPTION OF VAGINAL SMEAR CHANGES NOTED IN PROVED CASES OF INCOMPLETE ABORTION

Although our series of cases of incomplete abortion is relatively small, we feel, after repeated examination and careful study of the various types of cells contained in these smears, that we have been able to recognize sufficient morphologic changes to warrant publication of these findings as a preliminary report. It is not our intention at this time to try to establish these characteristics as definite vaginal smear signs of incomplete abortion. Our present series of cases is too small to do this, even though the following changes were observed regularly and consistently in almost every smear studied.

a. Superficial and intraepithelial cells are present in relatively small numbers and are about normal in size with small dark staining or pyknotic nuclei and homogenous pale blue staining cytoplasm. Occasionally we noticed the relative increase in size of the nucleus as seen in pregnancy smears. These cells are irregular in shape and may be fragmented, compressed or folded to a greater extent than in the menstrual smear and to a less extent than in the smears of early or late pregnancy. They correspond fairly well to those seen in post-partum smears.

b. Outer basal or pavement cells (Fig. 3) are present in sufficient numbers to cause them to be an easily recognized characteristic of the incomplete abortion smears. They are in general equally or more numerous than the superficial cells. Their nuclei are large in proportion to the cytoplasm, more so than is observed in the superficial cells in pregnancy smears. They stain a medium blue color with a pinkish tinge. They always take a darker stain than the cytoplasm, but the contrast is not as marked as in the superficial cells.

The cytoplasm is clear and homogenous but may contain a few fine granules. It may be definitely cornified, but the majority of cells show only partial cornification.

In size they are smaller than the superficial type. It is not unusual for them to be only half or two-thirds as large. The ratio of total nuclear to total cytoplasmic substance is about one to two, as a rule. This seems to be due to a decrease in size of the cell rather than to an increase in size of the nucleus. Papanicolaou described these cells only in post-partum and postmenopausal smears.

c. Inner basal or germinative cells (Fig. 2) are consistently also present in smears of incomplete abortion. They can be recognized easily, but were not readily identified at first because of their marked scarcity in all other types of vaginal smears studied. They are slightly smaller than the outer basal type, have a homogenous, medium to light blue-staining cytoplasm and a relatively

large nucleus that stains a darker shade of blue. They are well defined, discrete, round, oval or slightly irregular in shape. They show no indication of wrinkling or folding because they are too small. They correspond in general appearance to the outer basal cells but are smaller and more consistent in shape. We believe these two types of cells are indicative of incomplete abortion.

It seems reasonable that their presence may be accounted for by the fact that in the majority of instances, patients with an incomplete abortion are inclined to permit the condition to persist for relatively long periods of time before seeking medical advice and help. These women may be inclined to assume that their

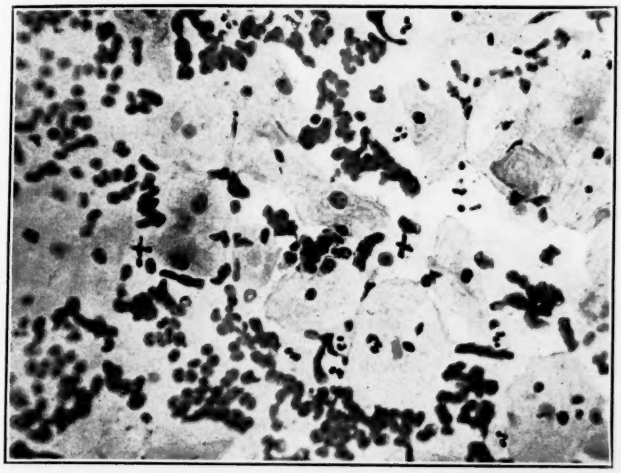

Fig. 2.—Superficial cells in case of incomplete abortion.

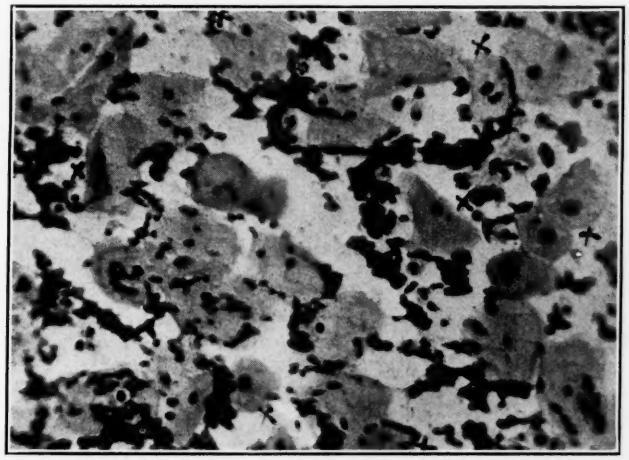

Fig. 3.—Inner and outer basal cells in case of incomplete abortion.

persistent vaginal bleeding is due to overwork, nervousness, domestic difficulties, fear, etc., and "will probably stop on its own accord within a few days." They are not seriously incapacitated and so may not be greatly alarmed about this condition until it has persisted for several weeks or months. Hence, we feel that the desquamative processes going on in the vaginal epithelium become more extensive and eventually involve these deeper layers of the vaginal epithelium.

As previously stated they are so consistently present in smears from cases of incomplete abortion that eventually we may be able to establish them as a definite, easily recognized sign of this condition which can be brought out by a relatively simple staining process.

Red blood cells, as might be expected, are abundant.

White blood cells are variable. In some instances they are surprisingly scarce but as a rule are present in considerable numbers and, in the presence of secondary infection, they dominate the picture. The presence of large numbers of polymorphonuclears, displaying evidence of high phagocytic activity, suggests the presence of secondary infection before other clinical symptoms and signs develop.

Mononuclears having a peculiar type of degeneration were observed in almost every smear studied in the incomplete abortion series. They are larger than normal and their nuclei is small, shrunken, fragmented, or absent. The cytoplasm is almost completely vacuolized while the cellular outline is distinct, discrete, and intact. At first this gave the impression of intercellular vacuole formation which had resulted from drying or some other type of artefact. However, their consistent presence and regularity in appearance warrant their consideration as a factor in these smears. They were carefully looked for in other types of

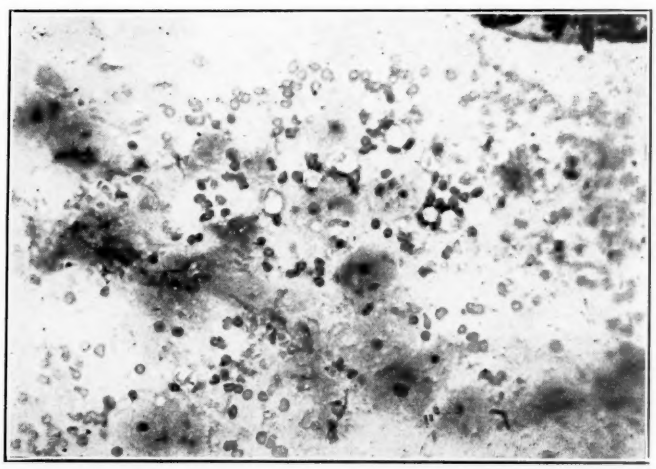

Fig. 4.—Mononuclear degeneration and vacuolization in case of incomplete abortion.

smears but were observed only once elsewhere, in a post-partum smear taken on the fifteenth day, from a patient making an uneventful recovery from a low cervical type of cesarean section. These cells were present in all incomplete abortion smears regardless of the type of staining technique used (Fig. 4).

In uncomplicated cases of incomplete abortion, mucus is present in relatively small amounts, and in some instances it is definitely absent. In the presence of secondary infection, it increases in proportion to the degree of activity caused by the infection and seems to be in proportion to the increase in number of leucocytes. In one case in our series, mucus was so abundant and so thick that it almost completely obscured the cellular aspect of the picture.

The amount of general debris corresponds sufficiently in all smears with the variations in amount of mucus to suggest that it be considered in conjunction with this fact.

TECHNIQUE FOR THE PREPARATION OF THE VAGINAL SMEAR

Our attempts with the use of the glass pipette suggested by Papanicolaou were unsatisfactory. After trying various procedures we were satisfied with results obtained by taking a swab from the vaginal wall with an ordinary wooden applicator, having a moderately-sized piece of cotton wrapped around one end,

applying it to either lateral wall in the middle third of the vagina, and turning it completely around twice. The material thus obtained was immediately transferred to a clean glass slide by *rolling* the swab back and forth twice in each direction, placing the slide in a half pint mason fruit jar, containing equal parts of ether and 95 per cent alcohol and allowing it to remain in this solution for at least an hour. Sometimes it remained there a week before being stained.

Our best results with staining were obtained by modifying the technique of Papanicolaou in the following manner.

Each slide was rinsed well in 70 per cent and 50 per cent alcohol, respectively, washed smooth in tap water and placed in Ehrlich's hematoxylin for two minutes, then transferred to a jar of running tap water and washed until the water in the jar was clear. Next it was placed in 0.5 per cent eosin in 30 per cent alcohol for one minute and again rinsed in water until the slide was "smooth," then placed in a solution of 0.5 per cent water-blue for five to twelve seconds, depending upon the thickness of the spread and the age of the stain, washed again in tap water and carried through 95 per cent alcohol, absolute alcohol and xylol until all "streaks" disappeared. This was accomplished by repeated rinsing in each solution. The slide was then mounted in Gum de Mar. Mounting, however, is unnecessary unless the slides are to be preserved. The exposed slide may be studied very satisfactorily under low power without "cover-slipping."

This procedure seemed to bring out color contrasts, cellular outline and detail more satisfactorily and more consistently than any other procedure tried.

In an endeavor to develop a more simple staining technique which would be applicable for use in the clinic or office and at the same time fulfill the requirements for a satisfactory vaginal smear, we were encouraged by results obtained after modifying the technique used by Dr. A. E. Doisy in his studies of vaginal smear changes in mice and rats.

It was obvious that hematoxylin and eosin would be necessary in any type of procedure since nuclear and cytoplasmic characteristics were being considered.

Dr. Doisy uses an aqueous solution of hematoxylin prepared by dissolving 1 Gm. of the crystals in 300 c.c. of distilled water and heating. Then 100 c.c. of a saturated solution of ammonium alum is added and the mixture allowed to stand for ten days. It is then filtered each time before using. Slides are placed in this solution for sixty to seventy-five seconds, removed, and washed in warm running tap water, then placed in a 0.1 per cent solution of eosin in 60 per cent alcohol for five to ten seconds and washed again in warm tap water, allowed to dry, and examined under the microscope.

After trying various time combinations and stains of different ages, we found that satisfactory results could be obtained by allowing slides to remain in a filtered solution of hematoxylin, of any age, for one minute and in 0.1 per cent eosin solution, in 60 per cent alcohol not more than one month old, for twenty seconds. The time was increased to thirty seconds when older eosin solutions were used. We found that solutions not used too frequently could be used for several months, since frequent use obviously causes dilution. A realization of the possibility of such staining solutions remaining in an office or clinic laboratory for long periods of time is what prompted us to consider this phase of our staining problem.

Although this staining technique leaves much to be desired in studying some types of vaginal smear problems, our results with this method lead us to believe that the various factors which seem to characterize the smear of incomplete abortion can be satisfactorily identified when it is used.

ADAPTABILITY OF THIS PROCEDURE AND TECHNIQUE TO OFFICE AND CLINIC USE

The various features which tend to characterize the vaginal smear of incomplete abortion, as described above, can be brought out by the simple hematoxylin-eosin staining technique used by Doisy, with our modification. The equipment necessary to institute this procedure

consists of a small bottle of Ehrlich's hematoxylin stain and a small bottle of 0.1 per cent eosin in 60 per cent alcohol.

The smear is taken with a small wooden applicator having a pledget of cotton wrapped around one end. This may be used dry or may be dampened with tap water. When used wet all excess water should be expressed. The smear is taken by stroking back and forth over the surface of the lateral wall in the middle third of the vagina, then the swab is *rolled* over one-half of a clean glass slide until a good spread is obtained. It is then fixed in equal parts of ether and alcohol for half an hour or a week without causing any appreciable damage to the smear. Satisfactory smears may be made without fixing if stained immediately, but we prefer to fix them first. It is then placed in a recently filtered solution of hematoxylin, prepared as outlined, for one minute, washed in running water and placed in a 0.1 per cent eosin in 60 per cent alcohol for twenty seconds then again washed in water. If hot or warm water is used the slide dries faster. After drying it is examined under the microscope with a low power lens. Mounting with a cover slip is advisable only when the slide is to be preserved.

SUMMARY

1. A short résumé of the history of the development of the vaginal smear is given to show that, while it is still a relatively new procedure, it has been studied sufficiently to be recognized as a definite scientific entity, with rather well-defined clinical potentialities.

2. The histomorphology of the vaginal epithelium has been investigated in many different ways. Although all investigators are not in complete agreement as to details, the general histologic facts have been recognized and accepted. It is these generally accepted facts that have been outlined and described in this paper and used as a basis for this work.

3. We have followed the technique described by Papanicolaou in the preparation of the vaginal smears. We have modified this technique somewhat in ways which seem to us to improve the detail and clarity of the smear. These modifications have rendered the vaginal smear more applicable for the type of work we have undertaken. A further modification has been developed to simplify the staining procedure in an endeavor to make this procedure available for office and clinic use.

4. Vaginal smear changes during pregnancy and after parturition have been carefully studied, for comparison with the changes noted in cases of incomplete abortion.

5. An endeavor has been made to recognize and identify changes in the vaginal smear that might be characteristic of incomplete abortion. Certain features of the smear that seem to qualify have been described in detail. It is suggested that these might be considered as definite signs of incomplete abortion. This paper is intended as a preliminary report and is not an endeavor to establish these findings as facts at this time.

6. Our plan of procedure has been outlined, the types of controls used have been explained and a résumé of our findings, has formed the basis for this paper.

7. The adaptability of this procedure for office and clinic use has been shown by an explanation of the surprisingly simple staining procedure that has been developed and found to fulfill the requirements necessary to bring out changes in the vaginal smear that seem to be characteristic of incomplete abortion.

CONCLUSIONS

1. The vaginal smear, as a potential diagnostic feature, is available for clinical use.

2. The vaginal epithelium undergoes definite cyclic changes that correspond to changes taking place in other parts of the female generative tract. These changes may be recognized by a study of the proliferative and desquamative processes that reflect themselves in the changes taking place in the cells of the vaginal epithelium.

3. These changes can be studied by the vaginal smear method. These smears may be satisfactorily prepared by using various types of staining combinations according to definitely established staining procedures.

4. A simplified procedure for the staining of vaginal smears in the clinic or office has been developed and outlined.

5. Vaginal smear changes that seem to characterize the condition of incomplete abortion have been pointed out and described.

6. It is suggested that these characteristics may eventually be established as definite diagnostic signs of incomplete abortion.

REFERENCES

(1) *Allen, E.:* Contr. to Embryol. No. 98, Car. Inst. Wash. **22:** pp. 45-76. (2) *Allen, Pratt, Newell, and Bland:* J. A. M. A. **91:** 1018, 1928. (3) *Adler, Karl:* Arch. f. Gynäk. **134:** 504, 1928. (4) *Davis, K. B.:* Am. J. Obst. & Gynec. **12:** 824, 1926. (5) *Dierks, Klaas:* Arch. f. Gynäk. **130:** 46, 1927. (6) *Geist, S. H.:* Surg. Gynec. Obst. **51:** 848, 1939. (7) *Hartman, C. G.:* Anat. Rec. **38:** 47 (prelim. report). (8) *Hitschman, F., and Adler, L.:* Monatschr. f. Geburtsh. u. Gynäk. **27:** 1, 1908. (9) *Kelly, G. L.:* Anat. Rec. **40:** 373, 1928. (10) *King, Jessie L.:* Contr. to Embryol., Publ. No. 363, Carn. Inst. Wash., pp. 79-94. (11) *Lehman, F.:* Zentralbl. f. Gynäk. **45:** 647. (12) *Mayer, Max D.:* Am. J. Obst. & Gynec. **18:** 347, 1929. (13) *Idem:* Am. J. Anat. **54:** 27, 1934. (14) *Novak and Everett:* Am. J. Obst. & Gynec. **16:** 499, 1928. (15) *Pankow:* Zentralbl. f. Gynäk. **21:** 38, 1928. (16) *Papanicolaou, George N.:* J. A. M. A. **86:** 1422, 1926. (17) *Idem:* Proc. Soc. Exper. Biol. & Med. **22:** 436, 1934. (18) *Idem:* J. Anat. (supp.) **52:** 519, 1933. (19) *Pouchet, F. A.:* Theorie positive de l'ovulation spontanee et de la fecondation des mammiferes et de l'espece humaine, basee sur l'observation de toute la serie animale, Paris, 1847. (20) *Puccioni, L.:* Riv. ital. di ginec. **6:** 544, 1927. (21) *Selle, Raymond L.:* Am. J. Anat. **30:** 429, 1922. (22) *Shorr, E., and Papanicolaou, G. N.:* Proc. Soc. Exper. Biol. & Med. **32:** 858, 1935. (23) *Smith, B. G.:* Anat. Rec. **43:** 343, 1929. (24) *Idem:* Am. J. Obst. & Gynec. **18:** 347, 1929. (25) *Stemshorn:* Zentralbl. f. Gynäk. **37:** 2387, 1928. (26) *Stieve, H.:* Ztsch. f. Nukrosh. Anat. Forsch. **3:** No. 3. (27) *Stockhard, C. R., and Papanicolaou, G. N.:* Am. J. Anat. **32:** 225, 1917.

Missouri Theater Building

DISCUSSION

DR. L. M. RIORDAN, St. Louis, Mo.—The "smear technicians" are able definitely to determine cyclic changes in the endometrium or vaginal mucosa while those who do deep biopsies are not. It was a very logical thing for Dr. Fletcher to try to adapt these procedures to the diagnosis of incomplete abortion.

We have used the smear staining technique of Papanicolaou and the technique that Drs. Fletcher and Doisy developed. We have not found these definite changes that he has found. We have occasionally noted these vacuolated pavement cells, but not as regularly as Dr. Fletcher has reported.

I would like to ask him upon how many cases this has been done and what is his percentage of positives as compared with other positive cases determined by the curette. Also, does he find the same things in tubal abortion as in regular abortion?

DR. PHILIP F. SCHNEIDER, EVANSTON, ILL.—We have not used this technique on the pregnant patient except in the early stages, but the data that Dr. Fletcher has presented certainly indicate that we can gain a great deal of knowledge from them.

The kodachrome slides I present represent smears which demonstrate the various pictures encountered, not only in menopausal patients but in other gynecologic conditions and even in disturbances during pregnancy, particularly nausea and vomiting. The first one is a smear taken before the patient received any therapy and shows an almost total absence of the normal cornified epithelial cells, with the presence of a large number of leucocytes and the basal cells that Dr. Fletcher mentioned.

The second specimen was taken after estrogenic therapy. The leucocytes and basal cells have disappeared, and the cornified epithelium appears. This fact is demonstrated by the increased affinity of the cell for eosin stain and indicates as shown by Papanicolaou that cornification is due to increased estrogenic action.

The third specimen shows that with an excessive amount of therapy cornification increases and intense eosin stain results with curling of the cells. In this particular patient excessive therapy was manifested not only by the smear but by a return of the same symptoms that she had prior to therapy when a deficiency existed.

I emphasize the above findings particularly since they seem to show that when basal cells are encountered in the vaginal smear they indicate estrin rather than progesterone deficiency, and that the presence of basal cells in those cases of abortion presented by Dr. Fletcher may have been due to the fact that estrin rather than progesterone deficiency has been the etiologic factor.

From our work we believe that we may learn more from the smears than from quantitative determinations of estrin, pregnanediol and gonadotropic hormone, and that the vaginal smear method may give us a more accurate though relative method of checking estrogenic activity.

In regard to the modification of technique Dr. Fletcher has suggested, we believe that rigid adherence to the technique outlined by Papanicolaou is indicated in each instance until its limitations are exhausted before attempts at simplification or modification are attempted or introduced.

THE MANAGEMENT AND TREATMENT OF HABITUAL ABORTION*

With Especial Emphasis on the Use of Progesterone

Ralph E. Campbell, M.D., and Elmer L. Sevringhaus, M.D.,
Madison, Wis.

(From the Departments of Obstetrics and Gynecology, and Medicine, University of Wisconsin)

HABITUAL abortion is still one of the most discouraging conditions to deal with in the field of medicine.

Spontaneous abortion presents a diversity of causes, such as: abnormalities, displacements, and inflammations of the genital tract; infectious diseases; germ plasm defects; tumors of the genital organs; dietary deficiencies; vitamin deficiencies; many alleged causes indicating serious investigation; and, last, the endocrine system in which the thyroid, ovaries, and pituitary gland are so important.

Important chemical investigations in endocrinology as related to the thyroid gland, ovaries, and pituitary gland, coupled with recent experimental data upon function, have been responsible for such advances in therapy as the use of progesterone and progestin-like extracts in the treatment of habitual abortion.

It has been very well established in the human being that the corpus luteum remains active until about the fourth month of pregnancy, and then begins to degenerate slowly until about the seventh month, when there remains little evidence of its presence or activity.

It has been shown experimentally in animals that the corpus luteum substance is necessary for the maintenance of normal pregnancy. There is every reason to believe that this stabilizing factor is present in the human being until the placenta is a controlling factor.

Experimental studies by Falls and his collaborators show very clearly in the human being that the estrogenic substance increases uterine irritability and muscle contraction, and the corpus luteum substance is the antagonistic factor. It was also shown that progesterone nullifies posterior pituitary response. These findings are important in relation to habitual spontaneous abortion and its treatment.

J. C. Hirst, of Philadelphia, in 1918 was probably one of the first to use corpus luteum extract in the treatment of habitual abortion. Falls, Krohn, and Lackner in 1935, Elden in 1938, and Kane in 1936 have reported favorably on the use of progesterone and progestin-like extracts in the treatment of habitual abortion. Carl Huber, of Indianapolis, in an unpublished series of cases of habitual abortion, has had favorable results with progesterone in the treatment of his patients.

---

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

These studies have been aided by a series of grants from the Wisconsin Alumni Research Foundation.

The participation of Dr. Frederick L. Hisaw and Dr. Roland K. Meyer in this investigation is gratefully acknowledged.

In our series there were 13 cases: Each patient had aborted twice or more and did not have a living baby. The exception was one patient who had a mature living baby followed by two spontaneous abortions. Of the 13 patients treated, 11 went to term and had spontaneous deliveries. One patient aborted at four months' and the other at six months' duration of pregnancy.

The following 6 case histories are representative of the whole group:

CASE 1.—The patient, a 31-year-old para 0, gravida iii, stated that her first pregnancy ended in abortion at ten weeks. The second and third pregnancies ended in abortion at eight and ten weeks, respectively. Her fourth pregnancy was an ectopic with operation on Sept. 19, 1933. This was her first appearance at our clinic. She had changed physicians several times and had received various types of treatment, but had received no endocrine treatment excepting thyroid. A complete physical examination was done by us and nothing remarkable was found. Her laboratory findings were within normal limits and the basal metabolic rate was +8.

The patient was seen on April 24, 1934, having had her last menstrual period on March 8, 1934, and having missed her expected period by two weeks. She was advised to take complete bed rest on May 11, 1934, when she commenced to stain, and it was thought that she was going to abort. Dr. Frederick L. Hisaw was consulted and furnished us corpus luteum (Hisaw's corporin) extracted by him from pigs' ovaries and properly standardized as to the rabbit unit dosage. This patient was given five rabbit units weekly, covering a period of twenty-eight weeks. This dose was unnecessarily large, as we know at present. The preparation then in use gave marked skin reactions, was in its experimental stage as to vehicle and clearing of its foreign protein; however, no abscess formation was observed. This patient was asked to cut her work and activities to a minimum. The patient's estimated date was Dec. 15, 1934, and she was delivered Dec. 13, 1934, of a normal, living male infant, weighing 3,508 Gm. The patient has had two spontaneous deliveries at term with normal living babies since the first term delivery and has received no endocrine treatment.

CASE 2.—A thirty-eight-year-old para 0, gravida iii, whose first pregnancy ended in abortion at three months in 1933. The second pregnancy a year later in 1934 ended in abortion at three and one-half months, and the third pregnancy a year later in 1935 ended in abortion at five months. During this period of three years, she had changed obstetricians three times. The patient was subjected during these periods of pregnancy to complete bed rest, tonics, thyroid, iodine, wheat germ oil, diet regulation, wearing of a pessary, and vitamin therapy. This patient was seen by us for the first time on Sept. 16, 1937. A complete physical examination was done and revealed little information, excepting a third degree retroversion of the uterus. The laboratory reports, which included a complete blood count, urinalysis, and blood chemistry, were within normal limits. Her Wassermann reaction was negative. The basal metabolism was +4. An endometrial biopsy was recommended and performed on the twenty-first day of the menstrual cycle and showed a poorly developed secretory endometrium. Her husband was given a thorough physical examination, including a prostatic examination and basal metabolism, and was found to be normal. No therapy was advised.

Dependent upon the endometrial findings, the patient was advised to take anterior pituitary gland injections. However, she failed to appear for treatment and returned three months later having missed her last menstrual period by a week. She was placed upon three rabbit units of corpus luteum extract weekly for twenty-six weeks. She was advised to reduce her activities to a minimum but was not placed at complete bed rest. Her last menstrual period was Dec. 4, 1938. Her estimated date was Sept. 23, 1938. The baby, a normal male, weighed 3,680 Gm.

CASE 3.—A twenty-two-year-old para 0, gravida iii, whose first pregnancy was an abortion at four months. The second pregnancy was an abortion at six weeks, and

the third pregnancy was an abortion at two months. All of her pregnancies were accompanied by severe nausea and vomiting, and the abortions were preceded by severe menstruallike cramps. This patient, like others in the series, had seen more than one physician and her treatment was diversified. The only endocrine treatment was thyroid administration. Her last period was April 18, 1937, and she was seen by us about five weeks subsequently. It was necessary because of nausea and vomiting to admit her to the hospital and give her treatment for vomiting of pregnancy. She was dehydrated, with acetone in the urine and on the breath.

She was started on a weekly dose of two rabbit units of progesterone while in the hospital, and the treatment was continued for twenty-eight weeks. The estimated date of confinement of this patient was Jan. 25, 1938, and she delivered Jan. 20, 1938, a normal living girl weighing 3,350 Gm.

CASE 4.—The first pregnancy of a thirty-year-old para 0, gravida ii, ended in a two months' abortion on Nov. 1, 1933, and the second pregnancy of ten weeks' duration ended in abortion on Oct. 31, 1934. During these two pregnancies the patient had experienced almost daily staining and menstruallike pains. On April 15, 1935, she had her last period and was pregnant for the third time. She was seen ten days after her May period should have appeared and was placed on three rabbit units of progesterone weekly for twenty-six weeks. She stained and passed clots throughout the first four months. Bearing down pains accompanied the entire pregnancy. This patient was diagnosed by the obstetric service as the hebephreniac type of dementia precox, and this diagnosis was not confirmed by the psychiatric service. The patient became troublesome and finally dissatisfied with our services, and transferred to another clinic where she was delivered at term of a normal living baby.

CASE 5.—A twenty-five-year-old para 0, gravida ii. This patient gave a history of two abortions at six weeks in 1933 and two months in 1934. Throughout both of these pregnancies she had almost daily vaginal staining accompanied by menstruallike cramps. On Jan. 8, 1935, she had her last menstrual period and was pregnant for the third time. The patient was placed upon two rabbit units of progesterone weekly for twenty-eight weeks. She delivered at term a normal living baby, weighing 3,600 Gm.

CASE 6.—A twenty-eight-year-old para i, gravida iv, delivered at term in 1935 of a living child. The patient aborted once in 1936 and twice in 1937. On Oct. 15, 1938, she had her last normal menstrual period and missed her November period. She was seen after missing her November period by a week and was placed upon two rabbit units of progesterone weekly for twenty-six weeks, and delivered a normal male infant, weighing 4,086 Gm.

DISCUSSION

Each patient in this series was very carefully checked by physical examination to exclude every possible causative factor as related to habitual abortion. Many of these factors have already been mentioned. Laboratory data were obtained, including a Wassermann test in all instances; in addition, patients admitted for study with histories of repeated spontaneous abortions have had basal metabolic rates taken, and an endometrial biopsy to study the secretory phase of the endometrium. Pregnanediol studies were useful, as well as studies of vaginal smears by the method of Papanicolaou. The authors feel that in certain instances a thorough examination of the husband should be made, including basal metabolic studies in some individuals. The babies were not excessive in size, presented no fetal abnormalities, and 11 were living. The progesterone dosage used in the several cases varied considerably and was much higher in the earlier years of treatment long before the commercial prep-

arations were on the market. We still feel that one to two rabbit units weekly is a safe dose so far as therapeutic effect is concerned.

Kane and others have used comparatively small doses of progesterone; however, the dosage necessary to prevent abortion is still empirical.

The Wassermann reactions in all cases were negative. In this series the authors were anxious to use only progesterone or the progestin-like extracts in order to find their single therapeutic value. Kane and others combine the progesterone with thyroid and sodium iodide to stimulate glandular activity in general; there can be no contraindication to such treatment when carefully controlled. Others combine the above with the use of wheat germ oil, which has proved effective in the treatment of habitual abortion as a single treatment.

J. Young feels that in habitual abortion there is a disturbance occurring in the metabolism of pregnancy in which a deficiency of vitamin E is involved.

CONCLUSIONS

This selected series presents little doubt as to the value of progesterone and corpus luteum extracts in the treatment of habitual spontaneous abortion. This treatment should not substitute for thyroid deficiencies and other obvious factors which may be responsible for the repeated spontaneous abortions. Let us be cautious in the present day *furor* of endocrine therapy to make certain that endocrine treatment is indicated and not a *misdirected substitute!*

REFERENCES

(1) *Kane, H. F.:* Virginia M. Monthly **62:** 334, 1936. (2) *Falls, F. H.:* Am. J. Obst. & Gynec. **29:** 198, 1935. (3) *Kane, H. F.:* Ibid. **37:** 110, 1936. (4) *Elden, C. A.:* Ibid. **35:** 648, 1938. (5) *Falls, F. H., Lackner, J. E., and Krohn, L.:* J. A. M. A. **106:** 271, 1926. (6) *Young, J.:* Brit. M. J. **1:** 953, 1937. (7) *Tanberg, A.:* Nord. med. tidskr. **12:** 1785, 1936. (8) *Witherspoon, J.:* New Orleans M. & S. J. **85:** 822, 1933. (9) *Geist, S. H.:* Am. J. Obst. & Gynec. **26:** 588, 1933.

4133 Manitou Way

DISCUSSION

DR. FREDERICK H. FALLS, Chicago, Ill.—If we give two ampoules of one rabbit unit of progesterone weekly after a patient with a history of habitual abortion has missed her first period, the cost to the patient for progesterone alone will amount to about one hundred and fifty dollars if she is carried on this dosage until the thirty-fourth week.

Dr. Campbell's figures show a percentage of 85 per cent successes. This corresponds to our combined series of 38 cases in which we got living babies that survived in 81 per cent. Our cases included patients who had a history of habitual abortion, and in many cases had symptoms of threatened abortion at the time treatment was begun.

We have tested a number of commercial preparations in the laboratory, using the intrauterine bag method in the seventh day of the puerperium. We find great differences in the amount of inhibition of uterine contractions produced by the injection of different products.

More recently we have been using the old corpus luteum extract proposed by Hirst in 1918, in the treatment of both abortion and hyperemesis gravidarum. We were told that progesterone was only soluble in oil and that therefore none

of the watery preparations could contain progesterone. Testing the corpus luteum extract, however, soon proved that 1 c.c. of the watery solution contained approximately one-tenth of a rabbit unit of progestin.

A word may not be amiss at this time regarding the use of morphine in the treatment of these patients. It will be seen from the tracings that if morphine does any good at all it certainly is not due to its inhibitory action on uterine contractions.

Finally, I should like to call attention to the similarity between spontaneous abortion and ablatio placentae. It seems to me quite probable that the same factors are at work in the two conditions; namely, increased uterine irritability and intrauterine hemorrhage. If this is so, the same management should apply to both conditions. This we find to be the case if we limit the treatment to those patients showing partial separations and apparent hemorrhage. We have found that progesterone will control the hemorrhage and stop further separation of the placenta and allow the pregnancy to go to term. In these patients in whom the fetus is on the borderline of viability at the time the first hemorrhage occurs, this is of the greatest importance. We have been able to cut the fetal mortality to 15.3 per cent in a series of 19 cases.

DR. CARL P. HUBER, INDIANAPOLIS, IND.—It is extremely important that the group of patients treated with corpus luteum hormone be limited to those who have had at least two previous abortions, and also that they be a group of patients in whom no other demonstrable cause for abortion is found. Prophylactic treatment of patients who have had one abortion in the first pregnancy is hardly justified.

During the past three years at the Chicago Lying-in Hospital and at the Indiana University Medical Center, I have collected a group of 15 patients who gave histories of repeated spontaneous abortions. Eight of them had two previous abortions. Seven had from three to seven previous abortions. In all but one of these cases, the pregnancy was carried to term. The amount of corpus luteum hormone which we used averaged one rabbit unit each week with two injections of one rabbit unit each being given during the week the patient would menstruate if she were not pregnant. The treatment was continued until a few weeks before term.

We have used both biologic and synthetic corpus luteum preparations and have been able to demonstrate no difference in their effects.

In the management of patients with threatened abortion, the results have not been nearly as satisfactory. The percentage of patients treated actively with corpus luteum therapy who failed to abort is small. I suspect that the reason lies in the fact that in many instances a patient who shows evidence of threatening abortion is aborting for some other reason than failure of corpus luteum hormone production.

DR. J. M. SINGLETON, KANSAS CITY, MO.—In July, 1938, I was confronted with two cases of threatening abortion where progestin, lutein, wheat germ oil, and sedation were failing. Vitamin K in its control on bleeding came to mind and this was administered in the form of dehydrated young grasses, with the hope that decidual hemorrhage would thus be inhibited. The results were almost immediately gratifying. Later investigation into the properties of dehydrated young grass revealed that it contained, in addition to vitamin K, factors which might play an even more important role in providing a continuously healthy nidation area. These are principally the gonadotropic factor described by Friedman, the grass juice factor, the reproductive and growth factors of Norris shown to be essential for high percentage in matching of eggs and vitamin E.

Of the 35 patients treated subsequently in this manner, 15 had a history of one or more previous spontaneous abortions and 3 should be placed in the habitual abortion class. Of the 15 cases, 11 patients continued with pregnancy. Of the three classed as habitual abortions, two continued with pregnancy. The one who aborted probably had a complete separation of the ovum before treat-

ment was instituted. These results were accomplished in the presence of a minimum dosage of the far more expensive progestin, and minimum sedation. In my opinion, patients with histories of habitual abortion should receive dehydrated young grasses before conception and throughout pregnancy.

DR. PHILIP F. SCHNEIDER, EVANSTON, ILL.—I would like to ask Dr. Campbell as to the number of cases in which progesterone has been unsuccessful in continuing pregnancy, following habitual abortion.

I should like to refer to two patients, showing weekly pregnanediol determinations, each of whom threatened to abort early during pregnancy, both sterility patients, one of five and the other seven years. From the eighth week, weekly pregnanediol determinations were obtained. At about the eighth or ninth week both patients threatened to abort as manifested by cramping and bleeding. With an increase in the amount of estrin in Case 1, the threat to abort subsided and the patient continued normally throughout pregnancy. The estrin was discontinued about the fourth month. The same result was obtained when the amount of progesterone was increased in Case 2. I think this observation is of particular interest, because it shows that quantitative values obtained apparently do not mean a great deal. In this instance two patients, one with very high pregnanediol values and the other with very low pregnanediol values carried through pregnancy uneventfully. This would seem to corroborate the suggestion of Novak that balance between the estrin and progesterone rather than the quantitative amounts of one or the other is the important factor.

DR. CAMPBELL (closing).—In answer to Dr. Schneider, we failed in two patients with histories of habitual abortion and, as far as treating threatened abortion is concerned, we have had little or no success.

SPONTANEOUS PNEUMOTHORAX OF THE NEWBORN INFANT*

EDWIN J. DECOSTA, M.D., CHICAGO, ILL.
(From the Maternity Service, Michael Reese Hospital)

SPONTANEOUS pneumothorax of the newborn infant should not be classified as a medical curiosity. It is a clinical entity which probably occurs frequently and is usually overlooked. No papers on the subject are to be found in obstetric literature, although references may be found in the pediatric and roentgenologic literature. This condition, certainly in its acute form, should command the attention of every obstetrician. The occurrence at Michael Reese Hospital of two instances of spontaneous pneumothorax in the newborn infant within one month is considered of sufficient interest to warrant this presentation.

CASE 1.—A white male, first child of a normal, 26-year-old mother, was born spontaneously after sixteen hours of labor. The second stage was of sixteen minutes' duration. The baby was cyanotic from birth but gave an occasional labored gasp. A swelling was visible over the upper portion of the sternum. Mucus was removed from the baby's throat and external stimulation was employed, but without avail. A tracheal catheter was therefore passed, and for thirty minutes tracheal insufflation was carried out by the House Staff. During this period the baby gasped

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

with difficulty and remained deeply cyanosed. Upon examining the baby at this time, it was apparent that the swelling over the sternum was caused by subcutaneous emphysema. The tracheal catheter was passed again and insufflation resumed. It was observed that the air entered the lungs with unusual difficulty. On percussion of the chest, the right side was hyperresonant and the diagnosis of right pneumothorax was made. A needle was introduced into the right pleural cavity, and 100 c.c. of air were aspirated. Immediately and almost dramatically the baby became pink, normal respiration was established, and the baby cried lustily. For the next twelve hours the baby was kept in an oxygen incubator. Convalescence was uneventful. There was no recurrence of the pneumothorax.

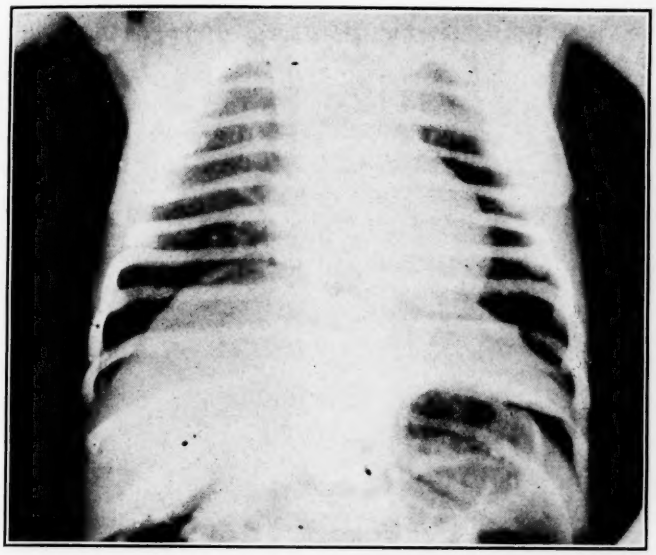

Fig. 1.—Case 1. Partial right-sided pneumothorax and left pneumoperitoneum.

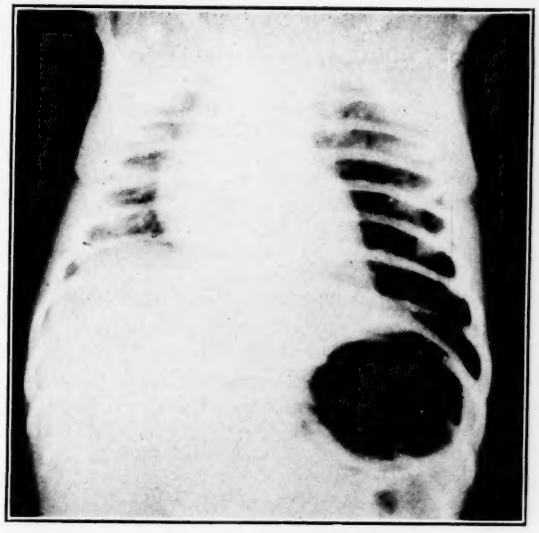

Fig. 2.—Case 2. Partial left-sided pneumothorax.

Roentgenogram of the chest taken the following morning revealed a small amount of air still present in the right pleural cavity, subcutaneous emphysema, mediastinal emphysema and pneumoperitoneum.

CASE 2.—A white, female baby, weighing 3,170 Gm., was born to a normal secundipara after four hours' labor. The duration of the second stage was fifty minutes. Delivery was spontaneous and resulted in a second degree laceration of the perineum. No abnormalities were noted at the time of birth, but on the following morning, during routine examination, the pediatrician on service observed a mild cyanosis with distant heart sounds. A roentgenogram taken shortly thereafter revealed pneumothorax on the left side with about 20 per cent collapse of the left lung and displacement of the mediastinum and heart to the right. Since the baby's condition was very good, no special treatment was instituted. A second roentgenogram taken six days later revealed complete absorption of the gas, with return of the mediastinum and the heart to normal position.

REVIEW OF LITERATURE

Sixty-seven instances of pneumothorax occurring during the first few months of life have been found in the world literature. This study considers only the 46 instances which occur in direct connection with birth plus the two cases herein reported. Ten days has been set as the maximum time for the recognition of pneumothorax associated with birth. This arbitrary time limit eliminates, therefore, 21 reported cases, many of which were in association with inflammatory lung processes or congenital anomalies. For a more complete recapitulation of spontaneous pneumothorax occurring in older infants, attention is called to the publication of Coccheri and Rossi.[1]

Analysis of the 48 instances, those definitely associated with birth, makes it apparent that there exist two distinct forms of pneumothorax. The first is illustrated by Case 1 herein reported. The symptoms date from birth or shortly thereafter. The baby is deeply cyanosed, dyspnea is marked and stridor may be present; the baby is unable to cry. Percussion usually reveals unilateral hyperresonance of the chest with displacement of the mediastinum and heart dullness. Roentgen examination will reveal complete or nearly complete collapse of one lung, with or without involvement of the other lung. Fourteen patients fell into this group, which, because of the sudden onset and critical condition, might well be designated *pneumothorax abrupta*. Six deaths occurred in this group, a mortality of 42.85 per cent. Furthermore, it is probable that at least two others would have succumbed had it not been for prompt aspiration of the chest. Aspiration was employed four times[2-4] in these 14 cases without a death.

Thirty-four patients presented a clinical picture similar to that of Case 2 which might be designated *pneumothorax lenta*. The symptoms are mild and include a gradual onset of cyanosis, perhaps noticed only when the baby cries, rapid respiration, and physical findings which may or may not reveal hyperresonance and displaced cardiac dullness. Roentgen examination reveals partial but occasionally even complete pneumothorax. Recognition of this type of pneumothorax was frequently late and often an accidental discovery. It must be emphasized, however, that the main difference between the two types lies in the severity of symptoms and rapidity of onset. In that group classified as *pneumothorax lenta*, only two babies died, both of cerebral hemorrhage,[5, 47] while aspiration was employed twice.[6, 7] Special treatment, if any, consisted of O_2 or $CO_2 - O_2$ inhalation, and respiratory stimulants.

In every surviving baby in the entire group, the pneumothorax disappeared within two to sixty days with the exception of the baby reported by Tideström.[6] Apparently this patient had a pulmonary fistula and probably should not be included in this series; it might well have been a congenital anomaly, as a thoracoplasty was performed subsequently.

Clinically there are only a few conditions that must be distinguished from pneumothorax in the newborn infant. Most common is simple blockage of the respiratory tract with aspirated material. Once the material is removed, spon-

taneous normal respiration should follow. Most difficult will be congenital lung cyst and diaphragmatic hernia. Here dyspnea, cyanosis, displacement of the mediastinum, hyperresonance, and increased resistance to tracheal insufflation will be present. Even a roentgenogram may not definitely establish the diagnosis of a lung cyst.[2] In addition, such conditions as atelectasis, pneumonia of the newborn, dextrocardia, and cerebral injuries must be considered.

A survey of all cases indicates that spontaneous pneumothorax occurs slightly more often in the male than in the female, and is more likely to be right sided than left. Most interesting are the 7 cases of bilateral pneumothorax in connection with which several unusual observations have been made. A. Hotz[8] observed an alternation from one side to the other within seven days, Riedweg[9] the same phenomenon in six weeks, and I. Holz[10] within three days. Bertin[11] in routine examination for enlarged thymus demonstrated normal lungs at birth but partial bilateral pneumothorax at one month. Rothman[12] observed bilateral pneumothorax following cesarean section.

The so-called spontaneous pneumothorax of the newborn infant may arise from several causes:

1. Congenital anomalies, such as pulmonary fistulas and abnormalities of the pulmonary vessels. Lung cysts must be distinguished from pneumothorax but such differentiation may be difficult. Pneumothorax has been confused with lung cyst,[2, 13] hence these cases are classed under congenital anomalies.
2. Inflammatory processes associated with small lung abscesses, either from pneumonia or septic emboli.
3. Trauma, including fractured clavicle, fractured rib, direct parenchymatous injury, and cough.
4. Mechanical obstructions such as mucus, vernix or meconium blocking the air passages, cord around the neck, struma, or enlarged thymus.
5. Artificial respiration.

In addition there is a large group in which the cause is undetermined.

TABLE I. STATISTICAL SURVEY

	PNEUMOTHORAX ABRUPTA 14	PNEUMOTHORAX LENTA 34
Average weight	3,464 Gm.	3,392 Gm.
Male	7	17
Female	4	14
Right sided	5	17
Left sided	4	13
Bilateral	3	4
Etiologic factors:		
Artificial respiration	8	2
Respiratory obstruction	1	12
Trauma	3	4
Unknown	2	16
Treated by aspiration	4	2
Died	6	2

No uncertainty exists in the pathogenesis of those cases associated with such congenital anomalies as bronchopleural fistulas.[14] Just how cardiac anomalies predispose to pneumothorax is not clear; perhaps the finding is incidental, but it has been observed four times in the series of 69 patients. Nor is there uncertainty in those cases associated with a pre-existing inflammatory process: an abscess forms, ruptures, and permits access of air to the pleural cavity.

The remaining cases, those associated with trauma, mechanical obstructions, artificial respiration, and that group without demonstrable cause, probably have a

common etiology, dependent upon increased intrapulmonic pressure and inability of the tissue to withstand that pressure. Of course, it is conceivable that direct lung injury and perforation by a fractured rib or clavicle might result in pneumothorax, but there is no definite proof of such a condition occurring.

To date, almost every author,[41] concerned with the clinical aspect of so-called spontaneous pneumothorax, has expressed the view that the pneumothorax results from the rupture of a subpleural bleb, the latter associated with alveolar rupture. Even Escudero and Adams[42] in their experimental work on massive atelectasis in dogs state that the observed pneumothorax results from rupture of a bleb on the hyperinflated side. Autopsy findings of dilated and torn air sacs,[3, 15] and in one instance of a true pleural tear,[16] would bear this out. However, autopsy may not reveal evidence of pulmonary injury.[5, 47] Likewise, with an actual rupture it is hard to conceive how a single aspiration will permit the lung to reinflate and not leak again; yet in several instances,[2, 4, 7] including the first case reported herein, a single aspiration of the pleural cavity was followed by complete cure. The frequent occurrence of bilateral pneumothorax[8-11] also makes this theory difficult to accept, because it implies rupture of blebs in each pleural cavity. Finally, the frequency of partial pneumothorax would imply either a low pressure leak, or one that rapidly seals itself.

As early as 1733 Stephen Hales[17] demonstrated that hyperinflation would cause air to escape from the pleural surface of the lungs without gross evidence of either bleb or rupture. In 1883 Ewald and Kobert,[18] repeating this work with excised lungs inflated in water, showed that the minimum pressure of inflation required to produce leakage in a given specimen remains the same on repeated tests, and that neither blebs nor tears were demonstrable. If rupture had occurred on these first tests, it would be reasonable to expect air to escape at lower pressures on subsequent trials. On this basis Kha T'i Lim[19] quoting Van Allen suggests that the pathogenesis may be explained by this phenomenon: air under pressure extravasates through the pleura and into the pleural cavity without rupture of the pleura.

In repeating this work with excised dog lungs inflated under saline solution, I have been unable to observe this extravasation of air from the pleural surface even at pressures of 100 mm. of mercury, a pressure far in excess of that to which the fetal lung could conceivably be subjected. Likewise, with pressures up to 100 mm. neither bleb formation nor rupture of the pleural surface has been observed.

Macklin[20] demonstrated that increased pulmonic tension will lead to pulmonary emphysema and extravasation of air along the perivascular sheaths into the mediastinum. Similar experiments by Joannides and Tsoulos[21] indicate the accuracy of this observation. I found that pressures as low as 18 to 20 mm. of mercury were sufficient to produce a bullous mediastinal emphysema in some dogs; yet there was no gross evidence of lung damage. How this air gets out of the alveolae remains to be proved. Ogawa[22] and others have demonstrated that pores apparently exist between alveolae in the lungs of animals, and Macklin[23] has described similar openings between alveolae in the human lung. Van Allen and his associates[24] have shown that these spaces, although normally collapsed, open under pressure, permitting communication between adjacent alveolae. It is possible that under pressure similar spaces permit air to escape into the surrounding connective tissue, following the perivascular sheaths until it reaches the very loose areolar tissue of the mediastinum.[47] Once mediastinal emphysema has occurred all the associated phenomena are easily understandable. Rupture of mediastinal blebs into the pleural cavities may produce right, left, or bilateral pneumothorax, and depending upon the amount of air in the mediastinum, the degree of collapse may be very slight or complete. Mediastinal emphysema may spread upward along the vessels into the cervical and axillary areolar tissue or downward through the hiatus aorticus and esophagus into the retroperitoneal tissue. From the retroperitoneal tissue a bleb could rupture into the peritoneal cavity, causing pneumoperitoneum, as in the case reported by Tunger,[25] or extension could occur along the iliac vessels eventually reaching the thigh through the femoral canal. Additional proof that these extensions do occur is furnished by the existence of mediastinal and subcutaneous emphysema and pneumoperitoneum in our first case as well as pneumothorax, and by the associated subcutaneous emphysema in the patient reported by Strongin.[2] The asymptomatic

subcutaneous emphysema that is not infrequently observed probably arises by the same process, without rupture of the mediastinal pleura. In a recent article Slot and Brown[26] report the occurrence of suprasternal subcutaneous emphysema in the newborn infant. The observation that little air seemed to enter the lungs, and the associated dyspnea and cyanosis, relieved only by oxygen, may indicate that they were confronted in addition with an unrecognized pneumothorax. A roentgenogram, taken after forty-eight hours and clinical recovery, failed to reveal lung pathology. It is possible that a bullous mediastinal emphysema, as observed on post-mortem examination by Schuler,[47] might of itself lead to both circulatory and respiratory embarrassment, with or without pneumothorax.

Another phenomenon was observed with dogs. When the pressure was quite high, 60 to 90 or more millimeters of mercury, the dog was likely to die suddenly of seeming cardiac failure. Post-mortem examination revealed, in addition to mediastinal emphysema, that the entire vascular system was filled with air bubbles and the heart

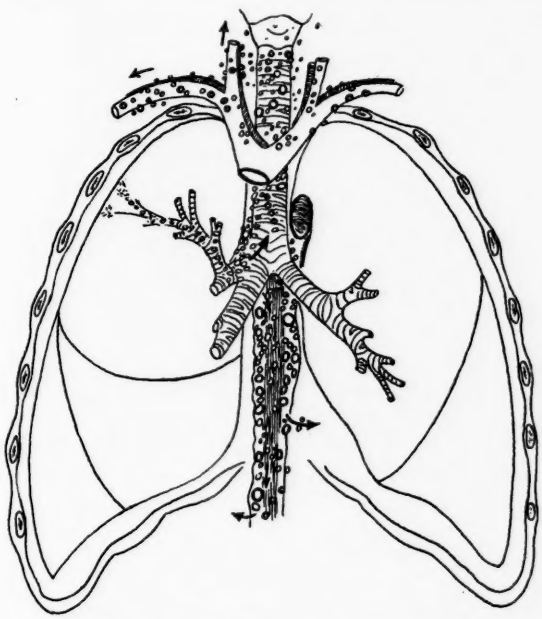

Fig. 3.—Diagram of course of extravasated air.

contained frothy blood. Air embolism seems to arise by the same process, only extravasation occurs into the capillaries. Lindblom[27] actually found air in the circulatory system of newborn infants who failed to respond to strenuously applied methods of artificial respiration.

Granting that these various phenomena may arise from increased intrapulmonic pressure, variations in permeability and strength of the lung tissue will greatly affect the outcome and degree of involvement. Thus it was observed that whereas 18 to 20 mm. of pressure was sufficient to cause mediastinal emphysema in some dogs, in others as much as 30 mm. were without gross effect. In a similar manner, many instances of labored respiration, including those associated with congenital malformation of the upper respiratory tract, may not lead to mediastinal emphysema or pneumothorax presumably because the baby's tissue is able to withstand the pressure to which it is subjected.

Having in mind the effects of increased intrapulmonic pressure, it becomes particularly interesting to consider further the effect of artificial respiration. For only 10 babies in the entire series of 48 is there information that some form of artificial

TABLE II. CHIEF FEATURES OF CASES REVIEWED*

CASE	AUTHOR AND DATE	WEIGHT	DELIVERY AND CONDITION OF BABY	AGE		SEX	SIDE AND TYPE	TREATMENT	TERMINATION	POSSIBLE ETIOLOGIC FACTORS AND REMARKS
				ONSET SYMPT.	WHEN DIAGNOSED					
				Pneumothorax Abrupta						
1	Ruge[16] 1878	Premature	Breech extraction. Asphyxiated	14 hr.	1 da.	M	L C		D	Rupture of an emphysematous vesicle. 3 cm. tear found in pleura
2	Flipse[3] 1928	3,590 Gm.	Forceps. Moderate asphyxia	Few hr.	24 hr.	F	L C	Asp. twice O_2	S	Collapse of epiglottis; artificial respiration, tracheal catheter
3	Bush[4] 1930	3,950 Gm.	Spontaneous	1 da.	32 hr.	M	R P	Asp.	S	Unknown
4	Emmert[29] 1930	?	Cesarean section	Birth	Few min.	M	L C	Con.	D	Alv. tear assumed. Artificial respiration (mouth to mouth)
5	Tollkühn[15] 1932	?	Spontaneous	1 da.	24 hr.	?	R C	Con.	D	Cough and rupture of an emphysematous vesicle
6	Deissler[28] 1933	Term	Forceps. Cyanotic from birth	Birth	P.M.	M	B C	Con.	D	Artificial respiration and Drinker. Rupture of emphysematous vesicles
7	Deissler 1933	Premature	Difficult delivery. Asphyxiated	Birth	P.M.	?	?	Con.	D	Artificial respiration
8	Deissler 1933	Term	Difficult delivery. Asphyxiated	Birth	P.M.	?	?	Con.	D	Artificial respiration
9	Riedweg[9] 1934	2,720 Gm.	Spontaneous. Apnea cyanosis, and stridor	Birth	1 da.	F	A-B R P birth & L P at 1½ mo.	Con.	S	Small thyroid enlargement
10	Riedweg[9] 1934	1,980 Gm.	Spontaneous, asphyxiated, pale	Birth	1 da.	F	R P	Con.	S	Art. resusc. Also aspiration of liquor

*A, Alternating pneumothorax; B, bilateral pneumothorax; C, complete pneumothorax; Con., conservative; D, died; L, left side; P, partial pneumothorax; R, right side; S, survived; P. M., post mortem.

11	Riedweg 1934	3,840 Gm.	Difficult, asphyx.	Birth	1 da.	M	R P	Con.	S	Art. resp., birth trauma
12	Rothman[12] 1937	3,660 Gm.	Ces. sect. (no indication given)	Birth	26 hr.	M	B	O_2-CO_2	S	Unknown
13	Strongin[2] 1938	4,535 Gm.	Manual rotation and difficult midforceps	4 hr.	4 hr.	F	L C	Asp. 100 c.c. air	S	Trauma. Erb's palsy
14	DeCosta 1939	3,110 Gm.	Spont. 17 hr. labor. Cyanosis and dyspnea	Birth	40 min.	M	R C	Asp. 100 c.c. air	S	Tracheal catheter
				Pneumothorax Lenta						
1	Scheltema[30] 1917	?	Spontaneous, asphyxiated	1 da.	7 wk.	M	L C	Con.	S	Unknown. Congenital anomaly assumed
2	Smith[7] 1919 (Reporting for Dr. Zuckerman)	(10 pounds at 7 wk.)	Spontaneous, asphyxiated	?	7 wk.	M	L C	Asp.	S	Unknown. (Died of bronchopneumonia at 3 mo.) Seen for rash on buttocks; accidental discovery
3	Tideström[6] 1924	2,975 Gm.	Spontaneous	10 da.	3 mo.	F	L C	Asp.	S	Unknown. Pneumothorax persistent, later had thoracoplasty (possibly a lung cyst or fistula)
4	Sorrentino[5] 1930	2,950 Gm. at 35 d.	Spont., prolonged	1-2 da.	35 da.	M	R C	Con.	D	Convulsions 3rd day; cerebral hemorr. on P.M.
5	Lim[19] 1932	?	Spont., difficulty with shoulders. Cyanotic. Grunting resp. first 48 hr.	1 da.	5 da.	M	R P	Con.	S	Cord short and around neck twice. Also enlarged thymus
6	Hotz, A.[8] 1934	3,010 Gm.	Spontaneous	5 da.	9 da.	F	A-B P	Con.	S	Large thymus. Alt. 5 da. 1 side, 12 da. other. Alv. tear assumed
7	Hotz, A. 1934	3,300 Gm.	Spontaneous	1 da.	15 da.	M	L P	Con.	S	Unknown. Alveolar tear assumed

TABLE II—CONT'D

CASE	AUTHOR AND DATE	WEIGHT	DELIVERY AND CONDITION OF BABY	AGE		SEX	SIDE AND TYPE	TREATMENT	TERMINATION	POSSIBLE ETIOLOGIC FACTORS AND REMARKS
				ONSET SYMPT.	WHEN DIAGNOSED					
8	Hotz, A. 1934	4,820 Gm.	Spont. Child asphyxiated. Dysp. and cyanosis	1 da.	12 da.	M	L P	Con.	S	Atelectasis or cerebral hem. Alveolar tear assumed
9	Willi[31] 1934	4,310 Gm.	Child asphyxiated	1 da.	7 wk.	M	L C	Con.	S	Cord around neck
10	Riedweg[9] 1934	3,100 Gm.	Cyanotic	Birth	4 da.	F	L P	Con.	S	Cord around neck and shoulder
11	Riedweg 1934	2,230 Gm. on 4 d.	Spont. Cyanosis and stridor	Birth	5 da.	M	R P	Con.	S	Large thyroid, cretin habitus. Asp. liquor
12	Riedweg 1934	2,900 Gm.	Spontaneous. Cyanosis and stridor	Birth	2 da.	F	R P	Con.	S	Enlarged thyroid
13	Riedweg 1934	4,060 Gm.	Forceps. 69 hr. labor. Asphyxiated, cyanotic	Birth	2 da.	M	R P	Con.	S	Fract. clavicle, birth trauma. Subcut. hemat.
14	Riedweg 1934	3,880 Gm.	55 hr. labor. Lively baby	3-4 da.	4 da.	M	R P	Con.	S	Long labor. Thought to have congen. heart. Cyanotic at 5 wk.
15	Riedweg 1934	3,770 Gm.	Spont. Sl. cyan.	1 da.	1 da.	M	R P	Con.	S	Unknown
16	Riedweg 1934	2,800 Gm.	Spont. Cyanotic	30 min.	2 da.	M	L P	Con.	S	Unknown
17	Riedweg 1934	3,940 Gm.	Lively baby	2 da.	2 da.	F	R P	Con.	S	Sl. enlarged thyroid
18	Riedweg 1934	?	Rapid. Lively	3 da.	3 da.	F	R P	Con.	S	Unknown
19	Folke[32] 1935	3,300 Gm.	Difficult. Asphyxia	1 wk.	3½ mo.	M	R P	Con.	S	Art. resp. by flexion
20	Heijbroek[33] van Ebbenhorst[40] 1936	4,290 Gm.	Asphyxiated	1 da.	5 da.	F	L P	Con.	S	Alveolar tear assumed. Cord around neck
21	Heijbroek[33] van Ebbenhorst[40] 1936	4,410 Gm.	No asphyxia	15 hr.	15 hr.	M	L P	Con.	S	Alveolar tear assumed. Cord around neck

22	Heijbroek, van Ebbenhorst 1936	3,930 Gm.	Asphyxiated	1 da.	1 da.	F	R P	Con.	S	Alveolar tear assumed. Cord around neck and enlarged thymus
23	Bertin[11] 1936	3,660 Gm.	Spont. Normal	8 da.	11 da.	F	R P	Con.	S	Unknown
24	Bertin 1936	?	L.F. Sl. cyanosis	1 da.	2 da.	M	R P	Con.	S	Ret. at 4 mo. and treated for enlarged thymus
25	Bertin 1936	?	Cesarean. Cyanosis (Previous diff. high forceps)	1 da.	1 da.	F	L P	Con.	S	Unknown. Accidental finding because of cyanosis with feeding
26	Bertin 1936	?	Difficult forceps. Asphyxia mild	?	9 da.	M	R P	Con.	S	Unknown. Accidental finding
27	Bertin 1936	3,660 Gm.	L.F. epis. No asphyxia	1 da.	1 da.	F	R P	Con.	S	Unknown. X-ray taken for thymus; accidental finding
28	Bertin 1936	3,940 Gm.	Spont. No asphyxia	?	1 mo.	M	B P	Con.	S	Enlarged thymus. X-ray 1st day normal. Pneumothorax at 1 mo.
29	Holz, I.[10] 1936	2,100 Gm.	Spontaneous, 6 hr. Cyanotic, dyspnea	Birth	2 da.	?	B P	O_2	S	Unknown. Malformed chest. Prominent xiphoid
30	Holz, I.[10] 1936	3,060 Gm.	Spontaneous, 4 hr. Marked asphyxia	Birth	4 da.	?	A-B L P 4 d. R P 7 d.	Con.	S	Hypertonicity indicates birth trauma. Trachea aspirated
31	Storts and James[34] 1936	2,538 Gm. 2 da.	L.F. Epis. asphyx.	2 da.	3 da.	?	L P	Con.	S	Mouth to mouth resusc. (Died 8 wk. intussusception)
32	Hotz, A.[46] 1936	2,400 Gm.	Spont. (A twin)	4 da.	6 da.	F	R P	Con.	S	Large thymus
33	Schuler, F.[47] 1938	2,840 Gm.	Spont. 5½ hr. labor. Cyanosis and dyspnea	Birth	15 hr.	F	R P	----	D	Birth trauma, and cerebral hemorrhage
34	DeCosta, E. J. 1939	3,170 Gm.	Spont., 4 hr. labor Sl. cyanosis	12 hr.	24 hr.	F	L P	Con.	S	Unknown, discovered in routine exam. of newborn

TABLE II—CONT'D

CASE	AUTHOR AND DATE	WEIGHT	DELIVERY AND CONDITION OF BABY	AGE		SEX	SIDE AND TYPE	TREATMENT	TERMINATION	POSSIBLE ETIOLOGIC FACTORS AND REMARKS
				ONSET SYMPT.	WHEN DIAGNOSED					
				Congenital Anomalies						
1	Meyer[45] 1859 (Quoted by R. T. Miller)	?		5 mo.	1 yr.	?	L	----	D	Congenital cystic lung
2	Miller, R. T.[44] 1926	?	Normal	2 wk.	5 wk.	F	R	Perm. Asp. 1 w. valve	D 5 mo.	Congen. cystic lung
3	Miller, R. T. 1926	?	Forceps. Mod. asphyxia	5 da.	5 da.	?	B	Con.	D 12 da.	Congen. cystic lung
4	Stein[13] 1930	?	Spontaneous	1 wk.	1 wk.	M	R	----	S	Apparently congen. cyst still present after 2 years
5	Weiner[14] 1930	?	Not stated		14 da.	?	L	Cont. perm. asp.	D	Congen. anomaly. Pencil thick patent bronchus opening into pl. cavity
6	Hotz, A.[46] 1936	1,730 Gm.	Cesarean for nephropathy. Asphyx.	5½ wk.	6 wk.	F	B	Con.	S	Congenital heart
7	Hotz, A.[46] 1936	3,340 Gm.	Spont. Pale on Birth	10 da.	17 da.	F	B	Con.	S	Congenital heart
8	Bertin[11] 1936	?	Spont. Cyanotic. Systolic heart murmur		8 da.	M	R P	Con.	D	Congenital heart. Died from pneumonia 2 mo. later
9	Miller, J. F.[39] 1937	?	Scanzoni	4 da.	4 da.	M	R	Asp.	D 2 da. later	Congen. abse. rt. pulm. artery, gangrene and rupture
				Inflammatory Pulmonic Processes						
1	Gasul and Singer[35] 1933	?	Normal. Resp. rapid and sighing from birth		3 wk.	M	R	Con.	D	Rupture of abscess of lung

2	Geyman and Clark[36] 1934	?	Normal	4 wk.	4 wk.	?	L	Con.	D	Br. pn. and pyopneumoth.
3	Hazek (quoted by Geyman and Clark 1934)	?		7 mo.	7 mo.	?	R	Asp.	S	Acute bronchitis followed in 2 days by pneumonia (bronchial). Had measles
4	Glazer and Landau[37] 1935	?	Normal		20 da.	M	L	Con.	D	Rupture of abscess of lung (Similar to No. 1)
5	Wilkinson[38] 1936	3,458 Gm.		5 da.	17 da.	M	L	Con.	D	Mult. sept. emboli, infarcts, abscess and rupture
6	Hotz, A.[46] 1936	?	Spont. Pale at birth, and rapid breathing	11 wk.	12 wk.	F	R	Con.	D 1 wk. later	Vitrum cordis with transp. vessels and bronchopneumonia
7	Holz, I.[10] 1936	3,300 Gm.	Spontaneous	5 wk.	6 wk.	?	L	Con.	S	Br. pneumonia—also verified by X-ray
				Recognition Later Than Ten Days						
1	Weiner[14] 1930	?	Normal	4 mo.	4½ mo.	M	L	Asp.	D	Unknown
2	Willi[31] 1934	2,790 Gm.	Membranes ruptured early, child cyanotic	3 mo.	3½ mo.	F	R	Con.	S	Respiratory obstruction due to large thymus. Present 2 yr. later
3	Willi 1934	3,500 Gm.	Normal	1 wk.	7 mo.	F	R	Con.	S	Bronchitis
4	Engel[43] (Quoted by Folke)	?		1 mo.	1 mo.	?	?	----	D	Unknown
5	Riedweg[9] 1934	?		?	12 wk.	?	R	----	S	Pylorospasm. Pneumothorax an incidental discovery

respiration was used. It may seem surprising that such methods were not employed more frequently in an attempt to relieve the embarrassed respiration. It must be remembered, however, that in many the babies' symptoms were so mild that they appeared only during crying and in several instances the discovery of the pneumothorax was accidental.[7, 11] Significant, though, is the fact that of the 14 *pneumothorax abrupta,* artificial respiration was used in 8, 57 per cent. It is difficult to determine definitely whether the pre-existing pneumothorax led to some artificial respiratory procedure or whether the attempted resuscitation produced the pneumothorax. But one must not ignore that in 57 per cent of the acute cases, artificial respiration was employed. From this it may be fair to conclude that any method of artificial respiration is hazardous and should be administered by one trained in its usage.

The fact that pneumothorax is not more frequently mentioned does not mean that it is not recognized. Failure to record cases may give the impression of rarity. For instance, in the discussion following Deissler's[28] brief autopsy reports of three cases of emphysema and pneumothorax following artificial respiration, Boyd and Steward mention that they have encountered several cases of emphysema and pneumothorax although they never reported them. Certain authors have witnessed from 6 to 13 cases,[8, 9, 11, 46] which indicates further that it is much more common than is suspected. The usual autopsy technique may not reveal the existence of such pneumothorax and many babies in which the diagnosis of atelectasis is made may have died because the lungs were unable to expand in an air-filled pleural cavity.

NOTE: Since this paper was presented, two additional cases of pneumothorax and one case of bullous mediastinal emphysema have been observed. The latter caused circulatory distress, which was relieved by aspiration of 6 c.c. of air.

SUMMARY

1. The literature on the subject of pneumothorax of the newborn infant is reviewed; 67 cases have been collected and studied.

2. Of these, only 46 have been directly associated with birth.

3. Two additional instances at the time of birth are reported, one unique in that subcutaneous emphysema and pneumoperitoneum were also present.

4. There appear to be two clinical types of pneumothorax in the newborn infant: one arising suddenly, *pneumothorax abrupta,* demanding prompt treatment; the other more gradual and less severe, *pneumothorax lenta,* with good prognosis irrespective of treatment.

5. Resistance to the flow of air through the tracheal catheter during insufflation is suggestive of pneumothorax.

6. The danger of producing pneumothorax by improper insufflation is stressed.

7. Pneumothorax is a condition that probably occurs much more frequently than the literature indicates. Obstetricians should be mindful of its possibility, especially when any method of artificial respiration has been employed.

I wish to express my appreciation to Dr. Louis N. Katz, Director of Cardio-Vascular Research, Michael Reese Hospital, for his encouragement and for making the animal experiments possible, and to Miss Erna Lindner for technical assistance.

REFERENCES

(1) *Coccheri, P., and Rossi, V.:* Arch. di Pat. e Clin. Med. **11**: 46, 1932. (2) *Strongin, Harry:* Am. J. Dis. Child. **56**: 110, 1938. (3) *Flipse, M. J.:* J. Florida

M. A. **14:** 403, 1928. (4) *Bush, Frederick W.:* Meet. Rochester, N. Y. Ped. Soc. 1930 (unpublished). (5) *Sorrentino, Catello:* La Pediatria **38:** 1175, 1930. (6) *Tidestrom, H. J.:* Acta Paediat. **4:** 380, 1925. (7) *Smith, C. H.:* Arch. Pediat. **36:** 184, 1919. (8) *Holz, A.:* Schweiz. med. Wchnschr. **64:** 209, 1934. (9) *Riedweg, J.:* Monatschr. f. Kinderh. **61:** 1, 1934. (10) *Holz, I.:* Kinderarztl. Praxis **7:** 3, 1936. (11) *Bertin, E. J.:* Radiology **27:** 584, 1936. (12) *Rothman, P. E.:* Arch. Dis. Child. **12:** 119, 1937. (13) *Stein, J.:* Am. J. Dis. Child. **40:** 89, 1930. (14) *Weiner, C.:* Arch. f. Kinderh. **91:** 14, 1930. (15) *Tollkühn, H.:* Ztschr. f. Kinderh. **54:** 133, 1932. (16) *Ruge, C.:* Ztschr. f. Geburtsh. u. Gynäk. **2:** 31, 1878. (17) *Hales:* Quoted by Van Allen, C. M.: J. Clin. Investigation **10:** 559, 1931. (18) *Ewald, J. R., and Kobert, R.:* Arch. f. d. Ges. Physiol. **31:** 160, 1883. (19) *Lim, Kha T'i:* Chinese M. J. **46:** 986, 1932. (20) *Macklin, C. C.:* Canad. M. A. J. **36:** 414, 1937. (21) *Joannides, M., and Tsoulos, G.:* Arch. Surg. **21:** 333, 1930. (22) *Ogawa, C.:* Am. J. Anat. **27:** 333, 1920. (23) *Macklin, C. C.:* Arch. Path. **21:** 202, 1936. (24) *Van Allen, C. M., Lindskog, G. E., and Richter, H. G.:* J. Clin. Investigation **10:** 559, 1931. (25) *Tunger, H.:* Monatsch. f. Kinderh. **67:** 264, 1936. (26) *Slot, G., and Brown, W. D.:* Brit. J. Child. Dis. **35:** 116, 1938. (27) *Lindblom, A.:* Virchow's Arch. **252:** 197, 1924. (28) *Deissler, K.:* Am. J. Dis. Child. **45:** 908, 1933. (29) *Emmert, F.:* Ibid. **39:** 1268, 1930. (30) *Scheltema:* Nederl. maandschr. v. geneesk. **6:** 407, 1917. (31) *Willi, H.:* Schweiz. med. Wchnschr. **64:** 229, 1934. (32) *Folke, L.:* Acta Paediat. **17:** 426, 1935. (33) *Heijbroek, N. I.:* Nederl. tijdschr. v. geneesk. **80:** 2468, 1931. (34) *Storts, B. P., and James, H. C.:* Arch. Pediat. **53:** 744, 1936. (35) *Gasul, B. M., and Singer, H. A.:* Am. J. Dis. Child. **45:** 1050, 1933. (36) *Geyman, M. J., and Clark, D. M.:* Radiology **23:** 622, 1934. (37) *Glaser, Jerome, and Landau, Daniel B.:* Am. J. Dis. Child. **50:** 986, 1935. (38) *Wilkinson, Scott J.:* Ibid. **52:** 361, 1936. (39) *Miller, J. F.:* Ibid. **53:** 1268, 1937. (40) *van Ebbenhorst Tengbergen, J.:* Fortschr. a. d. Geb. d. Röntgenstrahlen Ergänzungsbände **53:** 240, 1936. (41) *Pehu, M.:* Paris méd. **2:** 335, 1936. (42) *Escudero, L., and Adams, W. E.:* Arch. Int. Med. **63:** 29, 1939. (43) *Engel:* Quoted by Folke, L.: Handb. d. Kinderh. **3:** 659, 1924. (44) *Miller, R. T.:* Arch. Surg. **12:** 392, 1926. (45) *Meyer:* Quoted by Miller, R. T. (46) *Hotz, A.:* Kinderarztl. Praxis **7:** 152, 1936. (47) *Schuler, F.:* Arch. f. Kinderh. **113:** 160, 1938.

DISCUSSION

DR. J. MILTON SINGLETON, KANSAS CITY, MO.—I have an additional case to report. This patient had had two previous spontaneous abortions at four and four and one-half months, respectively. Labor came on prematurely at eight months, was tumultuous, and the baby was resuscitated with considerable difficulty. The baby was cyanotic, and when it cried cyanosis grew deeper. A film showed the line of collapsed lung and an outer area where there are no lung markings. X-ray taken after four or five days revealed that the area of pneumothorax had transferred to the other side.

The physical findings, absence of breath sounds, and hyperresonance confirmed the diagnosis. This case was of the mild type and responded to oxygen inhalations given several times daily over a period of ten days. X-ray taken on the fourteenth day revealed complete absorption of air.

In addition to this case, I have the privilege of reporting two others from Dr. Pakula's service.

CASE 1.—This was a full-term male infant. The labor had been induced and delivery was accomplished from the O.L.P. position by low forceps after twenty and one-half hours of difficult labor. The mother had received nembutal, scopolamine, and morphine. The child breathed only after 1.5 c.c. of coramine had been injected into the cord vessels, and oxygen and carbon dioxide given. Cyanosis persisted and the pulse and heart beat continued feeble. Physical findings were typical and the x-ray revealed the Mantle type of pneumothorax with persistence of the fold. No aspiration was done. Treatment was continued for fourteen days. X-ray and physical examination revealed complete absorption of air.

CASE 2.—This was a full-term male, delivered six and one-half hours after onset of labor in a third pregnancy. The first pregnancy had terminated in a stillbirth. The second baby died eight hours after delivery and was said to have

"choked to death." The third was an occiput posterior which rotated spontaneously. Twelve hours after labor difficult breathing developed and increased until sixteen hours after delivery there was marked cyanosis, inability to swallow, and shortly afterward shock. Examination revealed: (1) absence of breath sounds on the right side, (2) suggestive hyperresonance on the right side, (3) immobility of the right chest, (4) cyanosis, (5) evident shock. X-ray showed almost complete collapse of the right lung and the heart and mediastinum displaced to the left. The treatment consisted in aspiration of air by insertion of trocar needle in midaxillary line, which permitted outrush of air with relief of symptoms. The aspiration was repeated in forty-eight hours. X-ray taken the twenty-eighth day revealed complete return of structures to normal.

I present these cases to stress, with Dr. DeCosta, the frequency of this condition and to urge that it be more frequently considered in the care of the newborn infant.

DR. FREDERICK V. EMMERT, ST. LOUIS, MO.—My experience with spontaneous pneumothorax in the newborn infant is limited to one case. A sextipara, aged 42 years, near term, was admitted to the hospital with profuse bleeding due to a placenta previa centralis and, as the case was also complicated by a transverse position of the fetus, cesarean section was performed. After the operation, the nurse reported that the infant appeared normal at first, but soon became cyanotic and breathed irregularly. The color of the skin was deep blue and the respirations rapid and shallow. The infant continuously emitted moaning and whining sounds. Only when oxygen was administered and external heat applied did the condition improve. An x-ray picture was taken shortly before the infant died and showed "a complete atelectasis of the right lung. The left lung was also collapsed and pushed to the midline by a large accumulation of air in the thoracic cavity. The cardiac shadow did not seem to be enlarged."

These observations could be interpreted either as a congenital anomaly such as a pulmonary fistula or as the result of traumatism. It was learned that the child had not breathed promptly and that the intern had resorted to mouth-to-mouth insufflation which, as he insisted, had been gentle. However gentle his procedure may have been, the artificial pneumothorax proved that the force of direct insufflation had been far too great for the resisting strength of the frail tissues of the lungs.

The term pneumothorax should be applied only to cases developing in the period between birth and the establishment of the normal vital processes, or to the first four or five days of life. Lesions that make their first appearance after this time may be considered as disturbances having a different cause.

In addition to the massive pneumothorax in the newborn, there occurs much more frequently a partial pneumothorax, the so-called mantle type. It is due to the escape of small amounts of air from some ruptured emphysematous blebs. The escaped air rises into the pleural cavity around the apex of the lung and hence the mantle phenomenon.

DR. DECOSTA (closing).—The discussions clearly substantiate the contention that spontaneous pneumothorax of the newborn infant occurs more frequently than the comparatively few references in the literature would indicate. This paper has been presented with the hope that awareness of this condition will lead to its recognition, and thereby permit appropriate treatment.

TRANSVERSE ABDOMINAL INCISIONS IN PELVIC SURGERY*

A Report of Seven Hundred Cases

G. Wilson Hunter, M.D., Fargo, N. D.
(From the Fargo Clinic)

THIS study was prompted by the impression that lower abdominal transverse incisions are not widely used throughout this country. The writer was schooled to do longitudinal incisions, but upon observing the results in routine transverse incisions has become convinced that the latter are the most logical approach to pelvic pathology when laparotomy is indicated. I sent out a questionnaire to several leading gynecologists in the United States, and it was found that all but a few do not use the transverse incision or use it in less than 1 per cent of their operative cases. For the infrequent use of the transverse incision, these men gave various reasons. Among them were satisfaction with the midline incision, the greater danger of infection and the poor exposure with the transverse incision, or the opinion that this incision is illogical. In this study an attempt will be made to answer these objections and to cite the advantages of the transverse abdominal incision over the median or paramedian approach. A report of the results in 700 consecutive cases will be made.

HISTORY

Theodore Kocher was one of the first surgeons to try to find a substitute for longitudinal incisions in laparotomies. Reasons for this search were esthetic considerations and the desire to avoid postoperative hernia. He stated that one would get "beautiful" scars if the skin were incised along Langer's lines of cleavage. At the International Congress in Geneva in 1896, Küstner and Rapin recommended transverse incisions of the skin at or below the margin of the pubic hair. The skin was opened transversely, and the other structures were divided longitudinally as usual. Through the resulting small opening in the abdominal wall, pelvic surgery could be performed to a limited extent only. In 1900, Pfannenstiel of Breslau presented an extensive paper on the advantages of the suprapubic transverse incision of the fascia in gynecologic laparotomy. He had previously cultivated the vaginal route but had given it up because of poor exposure. His original resort to the vaginal approach was prompted by the high incidence of hernias and bad scars. He claimed that in order to remove these two principal objections to longitudinal laparotomies, he made his skin incision after the custom of Küstner-Rapin following which he made a transverse incision in the entire width of the anterior sheath of the rectus muscles. He stated that the Küstner-Rapin incision is esthetically ideal, but that it does not protect against hernias any more than the longitudinal incision does, since hernias result from defective healing of the fascia or aponeurosis, while perfect healing of the skin does not afford any protection.

Another early proponent of the transverse incision was Wanschler of Denmark, who added a new inducement for Pfannenstiel incisions for the purpose of excising some of the skin and superficial fat on women with pendulous abdomens

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

and intertrigo. Maylard made the interesting discovery that the rectus muscle could be sectioned with impunity when he found it necessary to enlarge his field of operation transversely after first having made a longitudinal incision. The transverse scar showed perfect healing while the longitudinal wound subsequently developed an incisional hernia. Following this incident, he began to use transverse incisions with complete section of the rectus muscles. He published his report in 1907.

In this country Stimson of New York was one of the first to use this type of transverse incision. In 1904 he published an analysis of 150 operations in which this incision was used. Boeckmann advocated transverse incisions for all abdominal operations in 1910, and gave excellent reasons for doing so. Sloan used the Pfannenstiel incision with modifications regularly from 1909 on. He stated that he is convinced of its superiority to the longitudinal incision because the dangers of postoperative hernia and of separation of wound margins are eliminated. Tovey thinks that the infrequent use of the Pfannenstiel incision in this country is probably due to the fact that it has rarely been properly described. In a personal communication to the author, Quain states that after seeing the satisfactory results in nearly 3,000 cases of transverse incision, he is more convinced than ever of the definite advantages over other more destructive incisions. During recent years there have been very few references to the use of the transverse incision in pelvic surgery in the American literature. Most of the current reports still originate in foreign countries.

ANATOMY

The anatomy of the abdominal wall will be reviewed briefly because anatomic considerations are the most important reasons for doing the transverse incision.

The abdominal wall consists mainly of a cylindrical sheet of voluntary muscles. The most important of these are the three aponeurotic transverse muscles—the external and internal oblique and the transversus abdominis. These aponeuroses fuse to form the anterior and posterior sheaths of the rectus muscles, and then pass medially to form the linea alba. The rectus muscles are longitudinal bundles divided by three or four strong transverse tendons into independent muscular masses, each of which has its own motor nerve supply. Thus, contractions may be considered segmental. This muscle layer is surrounded by a distinct sheath of fibrous tissue, the anterior layer of which is known as the deep fascia of the abdominal wall. The posterior layer is referred to as the transversalis, or endoabdominal fascia, and is too often disregarded in a repair of the abdominal wall. Superficial to the so-called deep fascia is a layer not unlike the superficial fascial layer, the subperitoneal fibroareolar layer.

The nerves have a more or less transverse direction while the blood vessels and lymphatics course longitudinally. The blood supply of the abdomen as a whole is rich except for the linea alba which is *practically nonvascular and equally destitute of lymphatics*. Since a well-healed wound depends upon the absence of tension between the freshly united margins of the wound, a good blood supply to and from the parts, and a ready absorption of exudates by means of abundant lymphatics, it is clear that the midline of the abdomen possesses these requisite conditions less than any other part. Conversely, if we consider the line to which these requirements are fulfilled to the utmost extent, it must course more or less transversely. Unlike the median incision, the transverse does not separate the aponeurosis crosswise, and contractions of the oblique and transversalis muscles do not exercise tension on the margins of the wound. Contractions of these muscles rather serve to bring the wound edges together.

Considering complete transverse division of the rectus muscles, one might presume that this procedure would leave a weakened abdominal wall or defective scar. This presumption is not supported by evidence. When a rectus muscle is divided, its fibers naturally retract but only to a very limited extent because of

its segmental nature. In the presence of healing, the rectus muscle forms an adventitious linea transversa which is particularly firm.

If we keep these anatomic relations in mind, we must conclude that, whenever an abdominal incision is made vertically or parallel to the long axis of the body, those structures which give the principal support and tone to the abdominal wall are being injured, that is, functionally impaired.

TECHNIQUE

There are two types of abdominal transverse incisions used in pelvic surgery, the Pfannenstiel and the Maylard (Fig. 1). Graves has referred to a Bardenheuer incision which is essentially the Maylard technique.

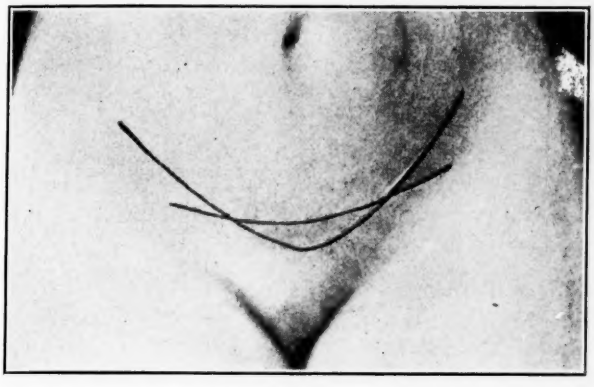

Fig. 1.—Pfannenstiel incision and modification. The Maylard may be made along the same lines by merely severing the recti.

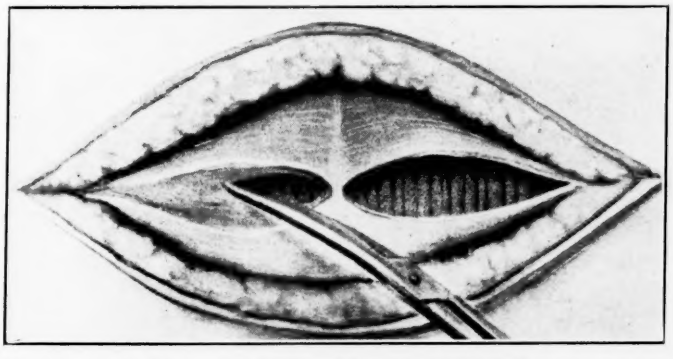

Fig. 2.—Pfannenstiel incision. Transverse incision is carried through the skin and the anterior layer of the rectus sheath.

The Pfannenstiel incision, like the McBurney, is to be regarded as a muscle-splitting operation. As originally described by Pfannenstiel, the skin, subcutaneous fatty tissue, and fascia were transversely severed about 4 cm. above the symphysis in an extension of 10 to 20 cm. (Fig. 2). This incision may be extended on either side by a curved incision in an upward direction, similar in shape to the transverse uterine incision used in lower segment cesarean section. The fascia is separated from the rectus muscles in upward and downward directions (Fig. 3). The rectus muscles are then separated and retracted laterally. The transversalis fascia is opened, and the peritoneal cavity entered (Fig. 4). The

level of the incision may vary, depending upon the size and situation of the pathology. It is possible to extend the curve of the incision as far as the anterior superior spines of the iliac crest, forming a convex line with the middle of the incision near the upper border of the pubis, the two upper extremities on a level

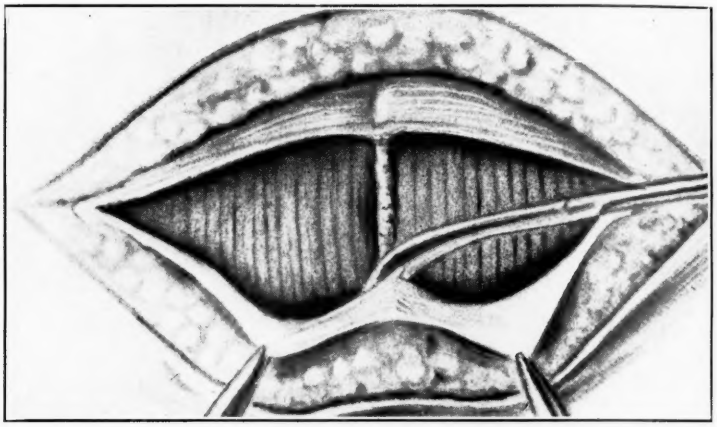

Fig. 3.—Pfannenstiel incision. The anterior sheaths are dissected superiorly and inferiorly to free the recti and allow their subsequent retraction.

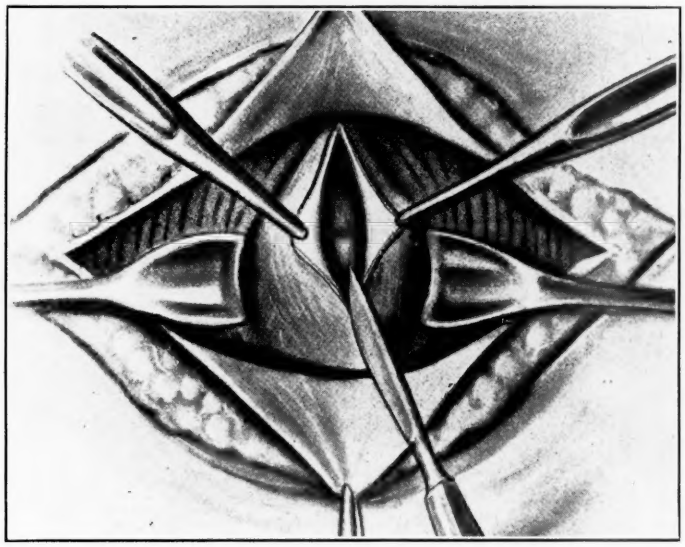

Fig. 4.—Pfannenstiel incision. The recti are drawn laterally and then their anterior sheaths are retracted superiorly and inferiorly; a vertical incision is made in the posterior sheath, which at this level consists of transversalis fascia, extraperitoneal fat, and peritoneum.

with the upper portion of the abdominal pathology. Close proximity to the pubis in the region of the mons veneris is inadvisable because of the possible cutaneous displacement with the scar falling on the upper edge of the superior ramus of the os pubis, leading to a painful pressure upon the scar region.

In the Maylard or Bardenheuer incision, the skin, subcutaneous fatty tissue, and fascia are incised at a suitable level, usually halfway between the umbilicus and pubis. The anterior sheath of the rectus is not separated from the

rectus fibers. The transverse incision is then carried directly through the rectus muscles down to the posterior sheath or transversalis fascia which is incised along with the peritoneum transversely.

In this review, different sizes and types of catgut were used in the repairs. However, in view of various studies, particularly Bates' investigation and Howes' work on tensile strength of catgut, the author now uses zero or finer gauge chromic throughout. Pfannenstiel incisions are closed in the following manner. Peritoneum and transversalis fascia with continuous suture; rectus muscles loosely approximated with continuous suture; the deep fascia with continuous suture which is re-enforced with interrupted sutures at intervals of 2 to 3 cm., and the skin is closed with medium or fine dermal. Stay sutures are not used routinely.

Maylard incisions are closed in the same manner, except that the rectus muscles are not sutured. Though some have held it necessary to suture the rectus muscles to the anterior sheath either before or after severing the muscle, experience has definitely refuted this view. The retraction of muscle fibers is insignificant. Approximation of the edges of the anterior sheath is sufficient to obtain good muscle healing. In certain individuals silkworm gut sutures may be advisable.

ADVANTAGES

Almost Complete Absence of Postoperative Hernia and Evisceration.—One is indeed impressed by the number of articles which have appeared in the last five years on incisional hernia and disruption of abdominal wounds. Furthermore, one's attention is drawn to the fact that almost all of these complications occur in longitudinal incisions. This fact in itself should be of sufficient importance to direct interest to the transverse incisional approach to the abdomen.

It is my firm conviction that the direction of the incision is the most important factor in prevention of these complications. Whatever the factors concerned in the production of hernia, section of the rectus muscle transversely is not a significant one. McNealy states that experimental and clinical investigations strengthen the impression that the transversalis fascia is the most important tissue concerned in preventing the development of any type of direct hernia.

Southam reports that 2 per cent of 29,000 operations were done for postoperative hernia. Coates reported a series of incisional hernias with a preponderant number occurring in paramedian and median incisions. In speaking of these, he concludes that they are not anatomically sound from the point of view of easy healing although necessary for exposure in some cases. Hepburn reports that wounds in the lower midline are apparently unduly susceptible to rupture. He feels that the frequency and seriousness of postoperative ventral hernia and the suffering which its victims undergo make this complication one of the major surgical problems.

In an analysis of 3,142 cases of hernia at Peter Bent Brigham Hospital, Branch reports that 9.5 per cent were incisional. In this series, 45.3 per cent were found to occur in lower midline incisions. Stated differently, incisional hernia occurred in practically one out of every 20 lower midline incisions. Can one fail to be arrested by this appalling figure when one notes that incisional hernia occurs in much less than 1 per cent of transverse lower abdominal incisions? (Peiro, Gianella, Sarwey, Hartzell and Winfield.)

Gianella, quoting Abel, reported that, in 9.8 per cent of the cases healing by first intention, hernia occurred where longitudinal incision was used. Abel made this deduction from extensive material. In 794 of Gianella's cases of the Pfannenstiel incision, 3 postoperative hernias occurred. During this period, 178

longitudinal incisions were made with 14 postoperative hernias, giving percentages of 0.38 and 7.86, respectively. It is worth stressing that out of 794 patients operated upon according to Pfannenstiel's technique 45 healings were complicated by infection but that the occurrence of hernia was avoided. Evisceration was completely avoided. From this, one would conclude that the incision was an important factor, particularly in the cases of wound infection. Peiro reports that not a single hernia occurred in 750 transverse operations.

Hartzell and Winfield, in a very thorough collective review on disruptions of abdominal wounds, state that this complication occurs in about 2 per cent of the cases. Quoting them further: "Many partial wound disruptions undoubtedly go unrecognized and frequently give rise to incisional hernias. Although the major effect of this catastrophe in many instances is an increase in the morbidity alone, the mortality nevertheless is extremely high, being variously quoted from 20 per cent to 75 per cent. . . . We feel that the evidence tends to militate against vertical abdominal incisions, and, therefore, urge the use of transverse

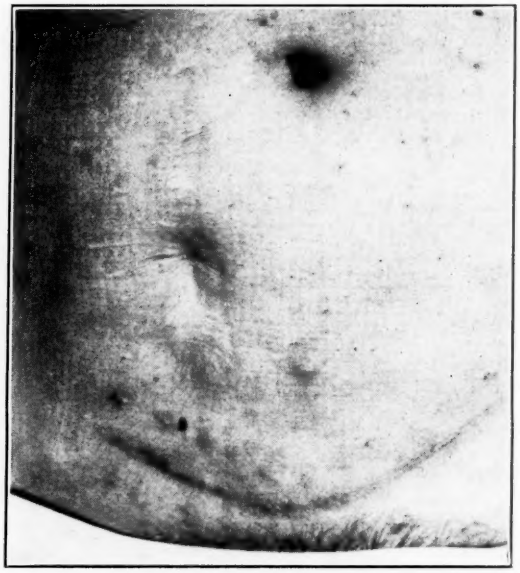

Fig. 5.—Right rectus and Pfannenstiel scars. When one encounters these incisions in the same individual, he sees how nicely the transverse incision heals by comparison. The rectus incision was done three years ago for acute appendicitis. The Pfannenstiel incision was done one year ago to relieve ruptured ectopic pregnancy.

and oblique muscle- and fascia-splitting incisions whenever possible. . . . During the past two years, we have become more and more inclined to the use of transverse or muscle-splitting abdominal incisions, and it is gratifying to note that not a single case of disruption has occurred in this group of cases. . . ." In summarizing they state that "consensus of opinion would indicate that wound disruption is essentially a complication of the vertical incision."

Why then do we adhere to the midline incision? Perhaps for the same reason that some of us cling to myths, such as, belief in the value of certain glandular extracts proved to have no biologic potency or the impression that two strands of catgut will give firmer wound healing than one. We are reluctant to change our habits.

Better Scar.—The desire to have better looking scars first prompted the older surgeons to use the transverse incision. Recently Conway

made a study of cutaneous healing in wounds. He emphasized the importance of placing the long axis of an incision parallel to Langer's lines of elasticity of the skin whenever possible. In his study, he came to the conclusion that the lines of elasticity of the skin run transversely in the suprapubic area rather than obliquely vertical as Langer's diagrammatical figure reports them. Photographs of healed wounds would tend to bear out Conway's conclusion. One has only to observe scars of longitudinal and transverse incisions on the same individual to be convinced of this fact (Fig. 5).

It may be argued that incisions in this region are not ordinarily displayed and that their appearance is a small matter. However, the esthetic viewpoint may not be disregarded. The thought of a hideous scar may conceivably restrain some from necessary surgery. It is frequently said that the patient judges the surgeon's handiwork by the scar.

Better Blood Supply to Wound.—A common objection to the transverse incision is increased bleeding. This very bleeding, however, speaks for the definitely better blood supply to the transverse wound —hence, for better healing. Albin stresses the poor nutritional condition of the wound as a factor in wound disruption. We know the blood supply is poorest in the midline, the most avascular region in the abdomen. It is made up of tissues of the least vitality. This results in a slower healing and, as many studies have proved, predisposes to postoperative hernia and evisceration.

The inferior epigastric vessels need not always be severed in the Maylard incision. However, if it is necessary to cut these vessels, the anastomoses are so numerous that the area does not suffer.

Because of the improved blood supply to the scar, there is more rapid healing and consequently quicker recovery. From an economic standpoint this is exceedingly important. Most surgeons keep patients who have had midline incisions in bed from ten to fourteen days. Those who have had Pfannenstiel incisions may get up safely as early as the fourth or fifth postoperative day, depending upon the extent of the surgery and the type of patient. Naturally, certain patients must remain in bed much longer.

No Division of Important Nerves.—There is likewise no division of important nerves when the median incision is used. However, in a transrectus longitudinal incision the tissue medial to the wound may suffer. In a transverse incision there is little danger of disturbing the nerve supply since the direction of the incision is parallel to the nerves. Heaney offers the objection that the pubic area is frequently anesthetic as a result of the transverse incision. With this objection in mind patients were questioned concerning presence or absence of sensation in the pubic area. Not one instance of anesthesia was noted. It is probable that it may occur when the incision is made too close to the symphysis.

The Tendency to Adhesions Is Greatly Diminished.—Sprengel was the first to draw attention to this. He noted when doing autopsies that it was rare to find omentum adherent to a transverse incision, whereas

it was relatively common in longitudinal openings. Furthermore, in many instances the laboriously united peritoneum had torn open. The higher incidence of adhesions in longitudinal openings is perhaps due to the increased lateral tension accompanied by the greater difficulty in peritoneal closure and the subsequent migration of the omentum to the wound site. In an experimental study Quain showed that disturbance of the nerve supply plus trauma or irritation predisposes to adhesions.

Sloan, in describing the requisites for prevention of adhesions, states: "It is of prime importance that an abdominal incision be used that does not destroy the nerve supply of any portion of the peritoneum and that can be closed without tension upon the sutures in contact with, or through, the peritoneum. This obviously cannot be done unless the fascia fibers remain intact. The transverse incision meets this requirement and also gives ample exposure."

Adequate Exposure.—When a vertical incision is made, the open wound must be stretched into a transverse aperture; with the transverse incision, such distortion is unnecessary and the exposure generally better. Occasionally the Pfannenstiel exposure may be considered inadequate and then the Maylard may be used. In fact, the transverse incisions may be made at any level. With the Maylard incision, the necessity for retraction is diminished and tissue trauma is less.

To those who argue that exposure is inadequate and more difficult with transverse incisions, I would urge that after all our purpose in gynecologic surgery is to expose the uterus, tubes, and ovaries. When the transverse incision is used, the pathology lies directly beneath the incision, and as a result, since there is less manipulation of the viscera, such complications as ileus are rare. In doing the low cervical cesarean section with transverse incision in the uterus the Pfannenstiel gives particularly good exposure.

The objection has been offered that the transverse incision cannot be extended to the upper abdomen to take care of possible gall bladder or stomach pathology. One does not often meet a situation where this would conceivably be necessary. The gall bladder can be palpated and the appendix removed easily through both the Pfannenstiel and Maylard incisions. Two good incisions are infinitely better than one poor one, should exposure of another portion of the abdominal cavity seem advisable.

One must, of course, decide whether the Pfannenstiel or Maylard is needed. Such a decision may be made at the beginning of the operation merely by making a small opening in the peritoneum before separating the rectus from its anterior sheath. In most of the cases this procedure will not be necessary, however, as one is usually able to outline the pathology through bimanual examination. When the Maylard incision is made, the exposure is excellent. The closure is easier because there is less gaping and little tension.

The Absence of Lateral Tension on Scar.—Whipple and Elliott recognize the importance of lateral pull of the oblique and transversalis

muscles in vertical incisions. Shipley states that a very important point is the transverse direction of the deeper layers of the abdominal wall, giving poor support to the suture line of a vertical incision.

The body and strength of the abdominal wall are made up of three lateral and superimposed muscles, the external and internal oblique and the transversalis. These muscles have been described above, but I should like to reiterate that the one broad tendon of these flat muscles unites at the midline with its partner of the opposite side. The function of these muscles is to pull outward and backward from the midline in front in order to increase the intra-abdominal pressure. Thus, opening the abdomen at the midline in the long axis of the body severs the structures which give the chief support and tone to the abdominal wall, placing a definite lateral pull on the incision.

Sloan has worked out a rule for estimation of the tension upon the suture line, following a longitudinal incision. "The longer the longitudinal incision the more force is required to bring the ends of the fibers of the divided aponeuroses together. The force required increases in proportion to the square of the length of the incision. . . . The lateral pull upon the suture line following a longitudinal abdominal incision is in proportion to the square of the length of the incision. . . . So far as we have been able to determine, when complete relaxation is not present, the lateral abdominal tension is about thirty times as great as the vertical. If this is correct, the strain upon the suture line of a longitudinal incision is thirty times as great as that upon the suture line of the transverse incision."

Farr calls attention to the fact that tension on transverse wounds can be lessened by simple posture change. He states that vertical wounds are constantly under tension—every hour of the day as long as the patient lives. If early hernia is avoided, the danger of its subsequent development remains, as scar tissue under strain will gradually lengthen and weaken.

Lower Morbidity and Mortality.—With an almost complete absence of evisceration and incisional hernia, the mortality and morbidity are necessarily lower. It is difficult to get figures of similar studies for comparing the incidence of wound infection. Hughson reports 5 per cent wound infection in a series of operations for inguinal hernia. Beekman reports 4.9 per cent wound infection in a study of complications following hernia repair. Curtis and others have held that infections in transverse wounds have more serious consequences. I might say the studies of Abel, Boeckman, and Sloan who have actually used the incision tend to refute this contention. It is my impression from data gleaned in this study that other complications are generally lower when transverse incisions are used.

DATA

TABLE I. GENERAL INFORMATION

Number of operations	700	
Pfannenstiel	673	96.1%
Maylard or Bardenheuer	27	3.9%
Mortality	13	1.8%
Unsatisfactory follow-up	130	18.6%
Stay sutures	180	25.7%
Vaginal drains	26	3.7%

TABLE II. OPERATIONS

On uterus:	
Suspension	214
Gilliam	172
Baldy-Webster	8
Olshausen	1
Coffey	2
Unspecified	31
Myomectomy	47
Supravaginal hysterectomy	104
Complete hysterectomy	53
Hysterotomy	2
On adnexa:	
Removal of one tube	112
Removal of both tubes	85
Sterilization	62
Plastic	12
Removal of one ovary, ovarian cyst, or parovarian cyst	177
Removal of both ovaries or bilateral ovarian cysts	30
Ectopic pregnancies	15
Miscellaneous procedures:	
Appendicectomy	355
Herniotomy	3
Presacral resection	4
Meckel's diverticula resection	3
Synechtenterotomy	29
Additional procedures done at one or more of the above operations:	
Dilatation and curettage	67
Lipectomy	5
Hemorrhoidectomy	5
Operations on cervix	27
Repair of cystocele	6
Repair of rectocele	16

TABLE III. POSTOPERATIVE COMPLICATIONS

Pulmonary		
Embolism	6	0.85%
Pneumonia	2	0.28%
Upper respiratory infection	6	0.85%
Pleurisy	1	0.14%
Intestinal obstruction	1	0.14%
Gastric dilatation	1	0.14%
Thrombophlebitis	12	1.7 %
Wound infection	26	3.7 %
Peritonitis	9	1.28%
Genitourinary		
Cystitis	4	0.57%
Vesicovaginal fistula	1	0.14%

DISCUSSION

Seven hundred consecutive cases of transverse incision are reviewed. A preponderant number (96.1 per cent) of these cases were of the Pfannenstiel type. The Maylard incision was used in 3.9 per cent of the cases, or about once in twenty-five. These figures emphasize the fact that the Pfannenstiel may be used for most pelvic abdominal

surgery. However, when the Maylard was used, there was no instance of impairment of wound healing, no evidence of failure of the ends of the rectus muscles to unite, and no instance of hernia or evisceration.

The incidence of wound infection in this series is 3.7 per cent. Of course, infection itself is not dependent on the direction of the incision. Our statistics indicate, however, that infection is considerably lessened by the transverse incision, the probable reason being the increased blood supply to the area which enables the tissues to combat infection more efficiently. Wound infections in transverse incisions certainly do not hold the serious consequences, namely markedly increased possibility of hernia or evisceration, that longitudinal incisions do.

Thrombophlebitis occurred in 1.7 per cent of the cases. This may strike some as high. However, it must be remembered that this study concerns only abdominal gynecologic operations. Hampton and Warburton found the incidence of thrombophlebitis to be 1 per cent in a study of 21,000 gynecologic operations at the Johns Hopkins Hospital. Eighty-one per cent of the cases of this complication occurred in abdominal operations. Hence, if one were to ascertain the incidence in terms of abdominal operations, the determinations would be considerably higher.

In evaluating general postoperative discomfort, it is difficult to make unbiased observations, but I should say that patients who have had transverse incisions complain less. They are certainly allowed to leave their beds earlier and return to physical work sooner.

Of the patients, 81.3 per cent had adequate follow-up in return office visits. Many of the remaining 18.7 per cent were referred back to their local physicians for subsequent care. It is likely that if any patient had developed a hernia she would have been reported. However, none was called to our attention. Nevertheless, the figure of 570 cases with adequate follow-up, revealing no evidence of postoperative hernia, is impressive. None of the 700 cases developed the slightest degree of wound disruption.

Stay sutures were used in 25.7 per cent of the cases. The fact that approximately three-fourths of the cases did not have stay sutures would add to evidence of others that they were not an important factor in prevention of wound disruption. I feel that they are not indicated in clean cases, but may be advisable when infection is known to be present.

The mortality rate was 1.86 per cent, 13 patients having died during the postoperative stay. Briefly they were as follows:

1. Aged 23 years. Patient apparently in good health. Operated upon for recurrent appendicitis and retroversion. Anesthesia death during operation.

2. Aged 47 years. Exploratory laparotomy. Carcinoma of ovary. Died on the fortieth postoperative day of metastatic carcinoma.

3. Aged 33 years. Supravaginal hysterectomy for fibroids. Pneumonia. Died on the sixteenth postoperative day.

4. Aged 30 years. Bilateral salpingo-oophorectomy. Bilateral hydrosalpinx and ovarian cysts. Died second day postoperatively of shock (?).

5. Aged 27 years. Suspension and appendicectomy for retroversion and recurrent appendicitis. Developed a bronchitis second day postoperatively. Diagnosis of intestinal obstruction on fifth day. Re-operated. Enterostomy done. Died two days later.

6. Aged 27 years. Hysterectomy for fibrosis uteri and membranous dysmenorrhea. Died ninth postoperative day of peritonitis.

7. Aged 44 years. Bilateral salpingectomy and appendicectomy. Bilateral pyosalpinx. Ovarian cyst excised. Died fourth postoperative day of peritonitis.

8. Aged 52 years. Panhysterectomy for fibroid uterus. Had a secondary anemia. Died of peritonitis on the eighth postoperative day.

9. Aged 40 years. Supravaginal hysterectomy. Right salpingo-oophorectomy for fibroids. Melanosis of adrenals. Died third day postoperatively of Addison's disease.

10. Aged 56 years. Panhysterectomy. Carcinoma of cervix. Died ninth postoperative day of peritonitis.

11. Aged 35 years. Bilateral salpingo-oophorectomy. Bilateral pyosalpinx. Died of peritonitis on second day postoperatively.

12. Aged 43 years. Exploratory laparotomy. Myxosarcoma. Died of metastases on eighty-sixth postoperative day.

13. Aged 45 years. Tubo-ovarian abscess. In hospital thirty-seven days before surgery. Died of cardiac failure on eighth postoperative day.

The cases of peritonitis occurred in patients who had hysterectomies or infected tubes. Five patients died of peritonitis, this being the most frequent cause of death.

The patients who died of metastatic carcinoma and myxosarcoma died on the fortieth and eighty-sixth postoperative days, respectively. Perhaps these may be properly excluded as nonoperative deaths. However, they are included in the statistics.

There were 418 operations on the uterus, most of them suspensions. The Gilliam suspension was used most frequently. The appendix was removed in 355 or slightly more than 50 per cent of the cases. The results indicate that the appendix may be safely removed in the average uncomplicated pelvic operation. It should not be electively removed in salpingitis, acute or chronic. The patients who had multiple procedures suffered a higher incidence of postoperative complications and generally required longer postoperative stays. The vesicovaginal fistula occurred following panhysterectomy for malignancy. Four instances of pulmonary embolism occurred in patients who were also diagnosed as having a thrombophlebitis. In at least two of these, the embolism occurred before there was evidence of phlebitis. None of these cases of pulmonary emboli was fatal.

Since this is a study primarily of transverse incisions and not of mortality and morbidity as limited to respective operations, a more detailed analysis is not given.

SUMMARY

1. Transverse abdominal incisions for pelvic pathology are not widely used in this country as revealed in answers to a questionnaire I sent out.

2. In my opinion these incisions are the safest and most logical approach to pelvic pathology when laparotomy is required.

3. The following advantages of this type of incision are stressed:

A. Almost complete absence of postoperative hernia and evisceration. Careful review of the literature reveals that these complications are essentially those of unphysiologic incisions, that is, incisions other than transverse.

B. Better scar. Incisions should be made along Langer's lines of skin cleavage.

C. Adequate exposure. The Pfannenstiel can be used in a preponderant number of cases and when one is familiar with this incision, he can usually get adequate exposure. The Maylard or Bardenheuer incision will give adequate exposure for any pelvic operation.

D. Better blood supply to wound with consequent better wound healing and lower incidence of wound infection.

E. Less tendency to adhesions. Some factor other than imperfect closure is responsible for the high incidence of adhesions following longitudinal incision.

F. Absence of lateral tension to wound.

G. Diminished morbidity and mortality with a shorter hospital stay and earlier return to physical work.

4. Seven hundred cases of transverse incision are reported without one instance of postoperative hernia or evisceration.

I wish to express my appreciation to Dr. N. Tronnes for suggestions and to other members of the Fargo Clinic, Fargo, N. D., for permission to use their cases in the preparation of this study.

REFERENCES

(1) *Albin, G.:* Ginek. Polska **11:** 563, 1932. (2) *Bates, R. R.:* Am. J. Surg., New Series **43:** 702. (3) *Beckman, F.:* Surg. Gynec. Obst. **68:** 1052, 1937. (4) *Boeckman, Eduard:* St. Paul M. J., June, 1910. (5) *Bier, A., Braun, H., and Kummell, H.:* Textbook of Surgery, vol. 2, Leipzig, Johan Ambrosus Barth, p. 273. (6) *Branch, Charles D.:* New England J. Med. **211:** 949, 1934. (7) *Callander, C. L.:* Textbook of Surgical Anatomy, Philadelphia, 1934, W. B. Saunders Co., p. 387. (8) *Coates, A. E.:* Med. J. Australia **1:** 7, 1938. (9) *Conway, J. H.:* Surg. Gynec. Obst. **66:** 140, 1938. (10) *Cullen, T. S., and Brodel, Max:* Bull. Johns Hopkins Hosp. **61:** 295, 1937. (11) *Davies, Joshua:* Surg. Gynec. Obst. **54:** 495, 1932. (12) *Deidesheimer:* Ztschr. f. artzl. Fortbild. **29:** 294, 1932. (13) *Farr, E. J.:* Lancet **32:** 561, 1912. (14) *Gianella, C.:* Monit. ostet.-ginec. **4:** 20, 1932. (15) *Graves, W. P.:* Gynecology, Philadelphia, 1918, W. B. Saunders Company, p. 768. (16) *Hampton and Warburton:* Bull. Johns Hopkins Hosp. **31:** 95, 1920. (17) *Hartzell, John B., and Winfield, James M.:* Internat. Abst. Surg. **68:** 585, 1939. (18) *Heaney, N. S.:* Personal communication. (19) *Hepburn, James J.:* New England J. Med. **204:** 1035, 1931. (20) *Hughson, Walter:* Dean Lewis Practice of Surgery **1:** Chap. 13, p. 31. (21) *Kocher, T.:* Textbook of Surgery, trans. by H. J. Stile from second revised German edition, p. 40, 1895. (22) *Küstner, D.:* Monatschr. f. Geburtsh. u. Gynäk. **55:** 197, 1896. (23) *Maylard, A. Ernest:* Brit. M. J. p. 895, 1907. (24) *McNealy, Raymond W.:* Journal-Lancet **59:** 262, 1939. (25) *Pannett, C. A.:* Surg. Gynec. & Obst. **30:** 408, 1920. (26) *Peiro, D.:* An. Hosp. de San Jose, Madrid **3:** 19, 1931. (27) *Pfannenstiel, J.:* Samml. Klin. Vortr. Leipzig, 1900, No. 268; Gynäk. No. 97, 1735. (28) *Idem:* Vereins-Beilage der Deutsche med. Wchnschr. **29:** 54, 1903. (29) *Quain, E. P.:* Am. J. Surg. April, 1914. (30) *Quain, E. P.:* Arch. Surg. **1:** 585, 1920. (31) *Sarwey, O.:* Zentralbl. f. Gynäk. **50:** 940, 1926. (32) *Shipley, A.:* Ann. Surg. **82:** 452, 1925. (33) *Sloan, G. A.:* Surg. Gynec. Obst. **45:** 678, 1927. (34) *Southam, A.:* Brit. M. J. **1:** 613, 1924. (35) *Sprengel:* Arch. f. klin. Chir. **92:** 526, 1910. (36) *Stimson, Lewis A.:* Ann. Surg. **140:** 178, 1904. (37) *Tovey, David W.:* Am. Med. **40:** 289, 1934.

DISCUSSION

DR. W. O. JOHNSON, LOUISVILLE, KY.—Dr. Hunter's presentation of 700 transverse incisions with a mortality rate of 1.86 per cent and a lessening of upper respiratory infections is convincing. Anatomically there is no doubt that the transverse incision is a superior incision.

One limitation to the transverse incisions is found in the patients with poor abdominal support caused by diastasis of the rectus muscles, from repeated pregnancy or multiple, large tumors. In such cases, I believe that the longitudinal incision should be used to approximate the recti in the midline. In the obese, thick-walled abdomen, the transverse incision is far more satisfactory and results in fewer wound avulsions.

One outstanding objection to this incision is that it takes time. This cannot be a real objection because it saves time in the major portion of the operation, by facilitating more adequate exposure.

Another possible objection to the transverse incision is the possible dissection of infection into dependent parts of the fatty tissue in infected cases, which may necessitate incision later for dependent drainage.

DR. GILBERT F. DOUGLAS, BIRMINGHAM, ALA.—I have used this incision for twenty years, and I have never seen a postoperative hernia in these cases.

There are just a few points that we must keep in mind in using the Pfannenstiel incision. First, we must expect to get a little more serum oozing than in a midline incision. To obviate that we leave a piece of rubber dam in the fascia for twenty-four to forty-eight hours. Second, there is some limitation as to the size of the tumor for which it may be used. Any fibroid up to the size of a three and one-half to four months' pregnancy can be removed easily through a Pfannenstiel incision.

DR. JOHN M. WAUGH, ROCHESTER, MINN.—Dr. Heaney expressed the belief that anesthesia over the pubic region frequently results from transverse incisions. This might be anticipated, as the terminal branches of the nerves could readily be severed, because they tend to run superiorly and inferiorly rather than parallel to the fibers of the external oblique muscle. Lymphatic drainage of the lower part of the abdomen is from the umbilicus downward toward the inguinal and pubic regions. Thus, the lymphatic vessels would be severed by any transverse incision and lymphatic drainage would be blocked. Incision in the median line interferes less with nerves and with blood and lymph vessels than does the transverse incision. Dr. Hunter's statement that the linea alba is almost avascular is true, but since it is practically a tendon, it requires less blood than does a muscle, which has work to perform by contraction of its fibers. This does not mean, however, that the tendon has less recuperative power than has muscle. On the other hand, repair of tendon and fascia is faster than repair of muscle because the latter is a more specialized tissue.

If, according to McNealy, the transversalis fascia is the most important tissue concerned in preventing the development of any type of direct hernia, certainly the Pfannenstiel incision is no improvement over the usual incision low in the median line, for in both incisions the transversalis fascia is severed in the same longitudinal axis.

In almost four-fifths of Dr. Hunter's cases, the uterus was not removed and some type of conservative pelvic procedure was performed which, of course, would help to explain the effectiveness of the Pfannenstiel incision in his group of cases as deep pelvic exposure was not often required. He found it necessary to resort to the Maylard incision only twenty-seven times, and it is possible that in a larger series of cases in which the latter incision was employed some weakness might become apparent.

All surgeons have seen incisional hernias develop, even in a McBurney incision made for appendectomy, and it is only reasonable to assume that such hernias will follow the Pfannenstiel incision when and if it is used as widely as the McBurney incision is employed. Certainly it must be agreed that because of the different axes of the incisions in the anterior sheath of the rectus and transversalis muscles

in the Pfannenstiel incision, the danger of evisceration should be less than when incision is in the median line. The Maylard incision does not have this advantage, however, as all layers are cut in the same axis.

In the last five years, at the Mayo Clinic, we have used the low transverse type of incision only two or three times in approximately 5,000 gynecologic laparotomies. The incision in the low median line has proved satisfactory and the incidence of hernia and evisceration is very low. I believe that either hernia or evisceration occurred in considerably less than 1 per cent of the patients. We feel that in making the incision low in the median line, it is important to open both sheaths of the rectus muscles, thus giving, in closure, the effect of three layers (peritoneum and transversalis fascia, rectus muscles, anterior sheath). Incision low in the median line seems to us to give better exposure and to require less time and cause less trauma in the making than does the transverse incision.

I would like to ask Dr. Hunter whether the follow-up study which he made in regard to hernia was conducted by letter or by personal examination. Also, was exposure with the transverse incision adequate for removal of huge fibromyomas and cysts?

DR. ARTHUR H. CURTIS, CHICAGO, ILL.—I do not employ the Pfannenstiel incision and therefore it is incumbent upon me to avoid bias in expressing my views. I have had occasion to open the abdomen subsequent to operation performed by others in many cases. In these I have been impressed with the deficiency of peritoneal and fascial tissues. This is so marked that closure of the peritoneum and fascia is exceedingly difficult, so much so that I always dread to operate on a patient who has previously had a Pfannenstiel incision. I should think that, with the necessary dissection of the abdominal wall, there would be a great tendency to infection between the layers, with the necessity of establishing secondary drainage in a rather considerable percentage of cases.

DR. W. A. COVENTRY, DULUTH, MINN.—When you want a nice clean nonvisible abdominal scar in a young girl it is a fine incision to make because years after you cannot find the scar. I have never seen a keloid scar in a Pfannenstiel incision. You do get serum in the wound once in a while, and I have had one infection. The method of approach and exposure in my opinion is not so good as in a longitudinal incision.

DR. WILLIAM F. MENGERT, IOWA CITY, IOWA.—We have been using both of these incisions at the University of Iowa recently. Closure of an abdominal wound depends on two things: gentle handling of tissue and accurate approximation. The principal advantage of the Pfannenstiel incision is the ultimate cosmetic effect. The principal advantage of the Maylard or, as we have been calling it, the Bardenheuer incision, is excellent exposure, since it is made directly over the condition which the surgeon wishes to reach. Particularly have we found it of advantage in fat women with overhanging, pendulous folds, because the incision is made below the fold, in the upper portion of the mons veneris.

DR. HUNTER (closing).—Dr. Johnson's point that diastasis recti cannot be completely repaired with the Pfannenstiel incision is well taken. However, the rectus muscles can be approximated below the umbilicus.

I was aware through a personal communication of Dr. Heaney's objection that the pubis was anesthetic following this incision. I purposely questioned all patients whom I could contact and I failed to find any instance in which anesthesia occurred.

Dr. Waugh's point that the transversalis fascia is separated longitudinally is a valid one. I would stress that there is, however, in the Pfannenstiel incision absence of lateral tension caused by separation of the aponeurosis of the deep fascia. I do not mean to imply that incisional hernias do not occur with these incisions. I merely meant to say that they are diminished in the Pfannenstiel and Maylard incisions. One cannot base conclusions on impressions. One must make factual studies. The follow-up in these cases was made by examination, not by letter.

SCARLET FEVER IN OBSTETRICS*

Report of an Epidemic

A. W. Diddle, M.D., Ray E. Trussell, A.B., and E. D. Plass, M.D.
Iowa City, Iowa
(From the Department of Obstetrics and Gynecology, State University Hospital)

EPIDEMICS of scarlet fever among obstetric patients are rare, and in no instance has an outbreak in this country been studied by modern bacteriologic and epidemiologic techniques. For these reasons it has seemed advisable to present the details of such an epidemic which occurred during the last winter (1938 and 1939) in a maternity service connected with a large general hospital.

The obstetric service of the University Hospitals receives patients (largely indigent) from all parts of the State, which has a total area of 56,147 square miles, and a population of approximately two and one-half millions. Prenatal supervision is given by local physicians until one to two weeks before the expected date of delivery. Admissions to the obstetric service vary from 120 to 175 each month. Physical conditions are such that considerable overcrowding is inevitable, and the danger of spreading contagious diseases is increased.

EPIDEMIOLOGY

Apparently the streptococcus involved in the epidemic was introduced into the ward by Mrs. H. C. (1), who was admitted on Dec. 17, 1938, with a near term pregnancy, an acute bartholinitis, and a severe upper respiratory infection of one week's duration. She presented a moderate cervical lymphadenopathy, but was afebrile. Three weeks later it was learned from relatives that she had been exposed shortly before admission to an individual in the prodromal stage of scarlet fever. The Bartholin abscess was drained on December 19. The patient was segregated in a two-bed ward where she was in contact first with Mrs. W. (2) overnight, and later with Mrs. P. (3), who also had a severe upper respiratory infection. On January 1, Mrs. H. C. (1) was delivered by low midforceps under local anesthesia supplemented by ethylene. On the following day her temperature rose to 102.4° F., and the pulse rate was 142 per minute. At this time she developed an acute laryngitis with almost complete aphonia. The temperature and pulse remained elevated, and the patient was isolated two days later, at which time it was learned that vaginal cultures contained gonococci and beta-hemolytic streptococci. This patient eventually developed a clinical, generalized peritonitis and was acutely ill for three months. When discharged at the end of four months, she was still incapacitated but free from fever. At no time during her illness was there any evidence of rash or desquamation.

The first case of scarlet fever appeared Dec. 25, 1938, in Mrs. F. (4), who had been admitted to the hospital Nov. 21, 1938, and had delivered December 19. Mrs. W. (2), who had been in the room with Mrs. H. C. (1) and later in the labor room with Mrs. F. (4), showed a rhinitis on December 26, delivered spontaneously on December 29, and later that day showed clinical scarlet fever. On Jan. 3, 1939, two ward nurses (5 and 6) and one staff member (7) presented sore throats.

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

These individuals had attended Mrs. H. C. (1) during her delivery and were relieved from duty. One nurse had hemolytic streptococci in the throat; the other two were not cultured. Mrs. C. W. (8), who was delivered on December 26, was in contact with Mrs. W. (2) and Mrs. F. (4) in the labor room and later in the ward. These three women were delivered in the same room and were given gas anesthesia from the same machine. On Jan. 5, 1939, Mrs. C. W. (8) had a transient rash associated with mild upper respiratory symptoms which were concealed from the staff and revealed only after her return home. She was discharged on January 15, and five individuals in her family developed either scarlet fever or sore throat within one week after her arrival home. This patient (8) had been in the same post-partum ward with Mrs. F. (4), Mrs. W. (2), and Mrs. M. S. (9) and later with Mrs. V. M. (15). Mrs. W. (2), who earlier had a rhinitis, later developed scarlet fever with septicemia and was transferred to the isolation ward where she eventually made a good recovery. Mrs. F. (4) also contracted scarlet fever, with cervical adenitis, and was treated on the isolation ward. Mrs. M. S. (9), who was delivered January 9, acquired scarlet fever on January 12. Mrs. V. M. (15) developed scarlet fever eight days after delivery. Mrs. I. F. (10), who had no direct contact with any of the patients previously mentioned, presented a severe endometritis two days after delivery. Vaginal cultures were positive for beta-hemolytic streptococci, but throat cultures were negative. She had been delivered by a student (11), who was discovered later to be a carrier. On January 14, the resident (12) on the obstetric service developed scarlet fever following a prodromal pharyngitis. The next day the nurse (13), who cared for him, complained of a mild pharyngitis. On January 15, one of the departmental secretaries (14), who had taken dictation from the resident (12), had mild fever and sore throat. On the sixteenth, typical clinical scarlet fever appeared, and she was sent to the isolation ward where she developed right otitis media but made an uneventful recovery.

Previous to January 13, all suspected and proved cases of scarlet fever had been transferred to the isolation ward, but other precautionary measures were not strictly enforced. On this date all individuals having had contact with these patients were subjected to throat cultures, the report from which (January 14) revealed two carriers, a ward maid and the previously mentioned resident (12). On January 16, throat cultures were made on all patients and attendants; two nurses, one student, and ten patients were found to be asymptomatic carriers of beta-hemolytic streptococci with colony morphology typical of the scarlet fever strains.

The service was closed to new admissions on January 16, and on the following day the entire hospital was restricted to the acceptance of emergency cases, following the appearance of scarlet fever in one of the surgical residents (16) on January 15, leading to the fear that the disease might not have been localized. Two days later the same diagnosis was made on an office boy in the Children's Hospital, physically separated from the General Hospital. No cultures were made on the office boy but later serologic study showed the resident to be infected with the type of streptococcus isolated from the obstetric patients.

Precautionary measures adopted on January 16 included the exclusion of all visitors, the dismissal of medical students from ward duties, the wearing of masks and gowns by all individuals entering the ward, and the adoption of the usual strict isolation techniques. Moreover, the patients on obstetrics and gynecology were divided into three groups, which were treated as separate units: (1) those who had no known contact with infected individuals or carriers and whose throat cultures were negative; (2) the gynecologic patients who had been free from the disease and among whom no carriers had been detected; and (3) those who were infected or harbored the organisms in their throats, or who had been exposed to definite cases or carriers. All patients presenting clinical scarlet fever were removed with their babies to the isolation ward. Others in this group who did not show scarlet fever were subjected to room isolation. Nurses beginning or finishing their services on the ward were required to have two consecutive negative throat cultures before the change was made. All carriers were dismissed from duty and hospitalized or isolated in their homes. Delivered patients were discharged home as soon as possible after one negative throat culture if they had been previously

and continuously negative, or after three consecutive negatives if their throat cultures had been positive for hemolytic streptococci. No attempt was made to isolate the babies of mothers with the various forms of streptococcic infections on the basis of current pediatric belief that newborn babies are not susceptible to scarlet fever. The infants of uninfected mothers were isolated from those of known infected mothers by barrier technique.

From this time (January 17), all individuals who developed scarlet fever or other clinical manifestations of streptococcic infections could be traced definitely to the patients already mentioned. The maternity ward was reopened February 17, twenty days after appearance of the last definite infection, and three days after the removal of all remaining patients to the isolation ward.

CLINICAL DATA

Between Dec. 17, 1938 and Jan. 17, 1939, 179 adults and 147 newborn infants were admitted to the obstetric service. During the following month (to February 17), 7 adults and 63 babies were received. During this two months' period, 140 individuals entered the adjacent gynecologic wards. Sixty-six nurses, 34 medical students, 3 secretaries, 16 maids and food-handlers, and 20 staff members were exposed to one or more of the obstetric patients or attendants harboring beta-hemolytic streptococci (Table I). Bacteriologic study showed that 80 of the 675

TABLE I. THE DISTRIBUTION OF THE VARIOUS DISEASE ENTITIES IN THE DIFFERENT CLINICAL SUBJECTS

DISEASE	ANTE-PARTUM WOMEN	POST-PARTUM WOMEN	BABIES	DOCTORS AND NURSES	OTHERS
Asymptomatic carriers	1	11	4	9	9
Scarlet fever	1	10	0	2	1
Rhinitis	0	0	3	1	1
Sore throat	3	5	0	6	3
Tracheobronchitis	0	0	7	0	0
Lymphangitis	0	0	0	1	0
Endometritis	0	2			

individuals concerned harbored beta-hemolytic streptococci at some time during the epidemic; while 5 others had clinical but no bacteriologic evidence of infection. Among the former group there were 34 asymptomatic carriers, 14 cases of scarlet fever, 22 of upper respiratory infection, 2 of endometritis, 1 of lymphangitis, and 7 of tracheobronchitis in the newborn. Of the 5 patients not studied bacteriologically, 1 had scarlet fever, 3 upper respiratory infections, and 1 (newborn) tracheobronchitis. Eleven cases of scarlet fever occurred among the obstetric patients, of whom only 1 was undelivered. In addition there were 2 physicians (from the obstetric staff) and 1 secretary who developed scarlet fever. In spite of the fact that the nurses were undoubtedly exposed more than any other group, and 5 were carriers of the offending strain of streptococci, no cases of scarlet fever appeared, although a few developed pharyngitis. This may be attributed to the fact that they had been immunized by the Dick technique. The incubation period for the cases of scarlet fever was from two to five days, with an average of three days. The exposed babies, who showed evidence of infection, had an incubation period of from seven to fourteen days, with an average of eight days.

The diagnosis of scarlet fever was never made in the absence of rash, although it was felt that clinically those patients with severe upper respiratory infections differed only in the absence of cutaneous manifestations.

In the babies, the clinical picture was that of an initial upper respiratory infection, which in certain instances progressed within one to three days to a tracheobronchitis. The nasal and tracheal discharges became abundant and tenacious. The respirations were labored, the temperatures rose to 101° F. to 104° F., and a moderate cyanosis made its appearance. No baby presented a rash or desquamation. In all but three instances the babies showing severe infections were of mothers who had scarlet fever.

There was no adult death in the series, but 2 babies died of tracheobronchitis with pneumonia. Among the adult patients there were 7 complications, including one of each of the following: superficial abscess of the finger, septicemia, generalized peritonitis, mastitis, otitis media, erysipelas, and superficial thrombophlebitis of the leg.

Asymptomatic carriers were treated with nasal instillations of 10 per cent argyrol, t.i.d. Prontylin was administered orally to a total dosage of from 140 to 1,080 gr., the largest daily dose being 80 gr. It was necessary to give at least 250 gr. within six days before the throat cultures became negative. In one instance the organisms disappeared from the throat only after the administration of 1,080 gr. over a twenty-two-day period. Since more than 50 per cent of these patients subsequently showed positive throat cultures, it is obvious that prontylin was of little value in controlling the carrier state. The acute infections were likewise treated with sulfanilamide and appeared to respond better. In these cases, larger doses, 120 gr. daily, were generally administered. The complications which arose were treated individually. Treatment of the babies was symptomatic.

Out of 19 case units (mother and baby) followed up directly or by correspondence after discharge from the hospital, 4 were known to have been the focus of an endemic outbreak of streptococcic infections. These patients had either had scarlet fever or upper respiratory infections or were known carriers. With the one exception previously noted, Mrs. C. W. (8), all of these patients had 3 negative throat cultures before discharge, or were accepted for control by the home physicians.

BACTERIOLOGIC DATA

From the recognition on Jan. 13, 1939, that an epidemic existed, until all precautionary measures were eliminated on April 2, 1939, 1,374 cultures for beta-hemolytic streptococci were taken. Eighty-nine individuals had one or more positive cultures as shown in Table II. Seventy-three of this group were actually involved in the epidemic, while the remaining 16 were asymptomatic carriers admitted after the service had been reopened. The figures given do not include cultures taken from patients removed to the isolation ward.

TABLE II. SITES FROM WHICH BETA-HEMOLYTIC STREPTOCOCCI WERE OBTAINED IN 89 PATIENTS

AREA CULTURED	PATIENTS, DOCTORS, NURSES, MAIDS, ETC., ON SERVICE WHEN EPIDEMIC STARTED		NEW PATIENTS ADMITTED AFTER SERVICE REOPENED	
Throat alone	68	72* cultures	14	14 cultures
Throat and vagina	1	2		
Vagina alone	2	2	2	2
Throat and erysipelas	1	2		
Throat and hand infection	1	2		
Total	73	80 cultures	16	16 cultures

*Four individuals had two different hemolytic streptococci in throat culture.

Ninety-six strains of beta-hemolytic streptococci were obtained from these 89 individuals. One strain was lost and 95 were subjected to Lancefield grouping, Griffith typing, agglutination and agglutinin absorption, in order to determine which strains were identical with the Type 3 streptococcus isolated from the patients with scarlet fever, and also to chemical reactions, fibrinolysis tests, and erythrogenic toxin determinations.

Lancefield grouping tests were done according to the techniques outlined by Coffey.[6, 7] All strains the acid extracts of which did not give precipitates with Group A antiserum obtained by immunizing rabbits with known Group A organisms were excluded after two negative tests. Scarlet fever strains of hemolytic streptococci are practically always of Group A. Among the 95 tested strains, 82 reacted with the Group A sera, but the 10 which had been isolated after the epidemic proper were excluded from further serologic study, thus leaving 72 for consideration.

Two strains (one from an early scarlet fever patient and one from a case of pharyngitis) were sent to Dr. F. Griffith,* of London, who designated them as Type 3 and Type 12, respectively, on the basis of agglutination tests with his type specific antisera.[10]

These strains were then used to produce antisera in rabbits for testing all of the other Group A strains by direct agglutination and agglutinin absorption techniques to determine those antigenically identical and thus presumably the same.

For this purpose, the serologic techniques of Dora Colebrook[8] were followed closely. Rabbits were immunized with heat-killed suspensions of the known Type 3 and Type 12 strains. Suspensions suitable for agglutination tests were prepared by formalizing the organisms obtained from a twenty-four-hour broth culture (150 c.c. of dextrose phosphate infusion broth). The cocci were then taken up in a small amount of M/15 disodium phosphate solution and transferred to a mortar where they were rubbed with a piece of absorbent cotton and additional phosphate solution. Repeated filtration until the suspension was uniform was carried out through cotton. This procedure was highly satisfactory in that only one of the 90 suspensions required remaking. This technique avoids the worst handicap of the serologic study of streptococci, spontaneous agglutination.†

The sera developed against the Type 3 and Type 12 organisms agglutinated the homologous organisms in 1:1600 dilution. For convenience, these will be spoken of as Type 3 and Type 12 sera, even though there was considerable cross reaction between the two. The 72 Group A strains were tested against the two sera by direct agglutination. The results are tabulated in Table III.

TABLE III. DIRECT AGGLUTINATION TESTS

TITER	TYPE 3 SERUM NUMBER OF STRAINS	TITER	TYPE 12 SERUM NUMBER OF STRAINS
0	5	0	5
1-100	0	1-100	0
1-200	0	1-200	11
1-400	0	1-400	26
1-800	6	1-800	13
1-1600	59	1-1600	15
Total	70		70

The most consistent findings were obtained with the Type 3 serum, but it was impossible to establish by this procedure the identity of all strains because of the cross reactions obtained with Type 12 serum.

Agglutinin absorption tests were performed on each of the 72 strains using the Type 3 serum. Similar antigenic content was indicated by exhaustion of the antibody content. Two-tenths cubic centimeter of 1:25 Type 3 serum was mixed with 0.2 c.c. of a suspension of the unknown organisms containing approximately 60 billion cells per cubic centimeter. The mixtures stood one-half hour at room temperature with occasional shaking, were then centrifuged, and 0.2 c.c. of the clear supernatant fluid pipetted off and tested for agglutinins by mixing with 0.2 c.c. of an agglutinating suspension of the Type 3 organism. Agglutination indicated antigenic dissimilarity between the homologous and unknown strains, because the latter had failed to exhaust the antibody content of the Type 3 sera in a dose three times the minimum absorbing dose of the known Type 3 strain. (This was previously determined to be 20 billion organisms per cubic centimeter.)

Sixty-four strains exhausted the 1:25 dilution of antibodies. Five of the remaining eight strains which did not remove the agglutinating antibodies had not been agglutinated in the direct tests. Two of the others later gave atypical sugar reactions, and one showed an atypical colony morphology.

*The authors express their appreciation to Dr. F. Griffith, of London, for aiding us in the preliminary serologic survey.

†This is the first time as far as is known that this procedure has been reported for use with streptococci. The technique was described to us by Dr. W. M. Hale who obtained it from Dr. I. C. Kakavas of the University of Delaware, who has worked out the technique for use with tubercle bacilli.

Among the 64 strains, however, was the Type 12 organism which almost exhausted the Type 3 serum in the 1:25 dilution, and thus prevented the definite separation of the Type 3 and Type 12 strains.

To attack the differentiation from the other angle, undiluted Type 12 serum (3 c.c.) was absorbed with five fractional doses of the centrifuged and washed Type 3 cells from a liter and a half of broth culture. After this treatment the serum no longer agglutinated the Type 3 organism in a titer of 1:10 but still agglutinated the Type 12 homologous strain in a titer of 1:320. This serum was specific for the Type 12 organisms in the collection and was used in a strength of 1:5 (final dilution 1:10) to test each of the other 71 strains. The three strains which were agglutinated and were therefore designated as Type 12, had been among those agglutinated in the highest dilution in the direct agglutination tests with the unabsorbed Type 12 serum.

Finally, undiluted Type 3 serum was absorbed with Type 12 organisms in a similar manner and as a result no longer agglutinated the Type 12 strain in a dilution of 1:12 but caused clumping of the homologous organisms to a titer of 1:96. There was, therefore, a demonstrable antigenic difference between the two, although the Type 12 organism could practically exhaust the Type 3 serum in a 1:25 dilution.

The final results of this part of the study are recorded in Table IV.

TABLE IV. TYPE DISTRIBUTION AMONG 72 GROUP A STREPTOCOCCI ISOLATED FROM INDIVIDUALS INVOLVED IN THE EPIDEMIC

	TYPE 3	TYPE 12	OTHERS
Patients			
Adult	32	3	4
Babies	11		
Doctors	4		2
Nurses	5	1	1
Maids	4		
Medical students	3		1
Secretary	1		
Total	60	4	8

Biochemical Reactions.—As noted above, 64 of the strains were found to be Type 3 or Type 12. Two of these were lost but the remaining 62 were subjected to biochemical tests (Coffey[6, 7]) and found not to hydrolyze sodium hippurate or ferment sorbitol but did ferment lactose, trehalose and salicin, and consequently can be classified as *Streptococcus pyogenes.*

Generally the ability of the organisms to dissolve human fibrin was poor; in 75 per cent there was no fibrinolysis under the Tillett technique,[14] whereas a strain unrelated to the epidemic caused lysis in thirty minutes, indicating that the plasma used was susceptible. The lack of strong fibrinolytic activity is consistent with the relatively mild clinical course of the scarlet fever and of the other related infections. The results are tabulated in Table V.

On the other hand, the demonstrable amount of erythrogenic toxin was of the usual order, since a 1:1000 dilution of a broth culture in a dose of 0.1 c.c. gave a reaction comparable to that of one skin dose of Dick toxin.

TABLE V. RESULTS OF FIBRINOLYTIC TESTS IN 62 GROUP A STREPTOCOCCI

RAPIDITY	TYPE 3	TYPE 12
4-plus	0	0
3-plus	2	0
2-plus	7	2
1-plus	4	1
Negative	45	1
Total	58	4

The four Type 12 strains, which were definitely identified, were isolated from one patient with simple pharyngitis and three asymptomatic carriers and appeared to have no direct bearing upon the development of the epidemic.

Thirty-two samples of air, each representing 10 cubic feet, were taken by Dr. K. MacDonald from several locations on the maternity ward during the height of the epidemic. In the entire number of samples, which represented a total of 320 cubic feet of air, only 4 colonies of hemolytic streptococci were grown. Under normal conditions of respiration, a man breathes approximately this amount of air in twenty-four hours. The extreme dilution of streptococcic droplet nuclei thus demonstrated, suggests that the danger of air-borne transmission must have been very slight.

DISCUSSION

According to Burton and Weir (1936) scarlet fever during pregnancy and the puerperium was first described by Hamilton, in 1470, with later accounts by Welsh (1635) and Ludwig (1758). In 1799, Mafatti, and, in 1826, Senn presented their classical reports, followed in 1876 by Olshausen's dissertation. The most recent authoritative article is by Sèdallian (1935), which also includes observations on the newborn. Byers, in 1912, recorded an epidemic in Belfast with approximately 1,500 cases, representing 1.8 per 1,000 of the population. During 1910 and 1911, 1,259 cases of scarlet fever were treated in the city hospitals, which during the same year cared for 2,964 obstetric patients, none of whom contracted the disease.

It has long been recognized that the incidence of scarlet fever is much greater in puerperal than in pregnant women, and, in 1876, Olshausen postulated an increased immunity during gestation. This view has been widely accepted and is supported by collected statistics, which indicate a puerperal mortality rate has varied from 0.0 to 100.0 per cent and the infant mortality up to 13 per cent.

During the 13 years from July 1, 1926, to June 30, 1939, there were approximately 12,000 deliveries in the University Hospital, with 13 cases of scarlet fever, 2 ante partum, and 11 post partum. Eleven of these patients were observed during the epidemic here recorded, with one case each in 1935 and 1936. The single fatality (1936) involved a primigravida, aged 22 years, who delivered spontaneously thirteen days after the onset of the disease and died forty-nine days post partum from parametritis and streptococcic septicemia.

In the present epidemic, the incidence of clinical scarlet fever was 1:140 in ante-partum women, 1:14 in those who were delivered, and 1:83 among the attendants. In the State of Iowa, there were 1,526 reported cases of scarlet fever during the three months (December, 1938, through February, 1939), an incidence of 1:1,650 of the population. In the opinion of the state epidemiologist the reporting of scarlet fever is so inadequate that the actual incidence is considerably greater than indicated.

It is generally believed that newborn children are immune to the disease, a view which is supported by Rominger (1919), Dorner (1920), and Bohn (1877). On the other hand, Boxall (1888) stated that the child might contract the disease in mild form if allowed to suckle the mother, and Allan (1905) recorded scarlet fever in a child 3 weeks old.

In the epidemic here recorded, no effort was made to isolate the babies from the mothers, even when there was clinical or bacteriologic evidence of streptococcic infection. A total of 210 babies were more or less exposed during the epidemic. In 177 instances direct exposure was not proved and none of these babies developed any manifestations of infection, while 33 infants had known direct contacts with infected adults, and 10 (30.3 per cent) gave objective evidence of infection. There was no clinical scarlet fever. Respiratory symptoms appeared eight to twenty-six days after birth in the breast-fed babies. The only two fatalities occurred in premature infants who had never been suckled, but who were fed by a nursery maid who was found later to be a carrier. The mortality rate for those known to have been exposed was 6.1 per cent.

Watson (1928), in reporting an outbreak of puerperal sepsis in the Sloane Hospital for Women, emphasized the role of asymptomatic carriers in the spread of the streptococci, and pointed out that carriers are not uncommon. It is also well recognized that the beta-hemolytic streptococcus may produce a variety of clinical manifestations, depending upon the site of the infection. The two cases of severe endometritis in this series were most probably due to the scarlet fever streptococcus, since this organism was isolated from the uterine discharges. One of these patients had streptococci in the throat while the other was attended by a medical student who was shown later to be a carrier. In the two women with skin infections (localized superficial abscess and erysipelas), throat cultures revealed organisms identical with those grown from the local lesions. The 14 cases of scarlet fever were probably acquired through droplet infection from others with the disease or in its prodromal stage, or from asymptomatic carriers, although the exact mode of transfer was not always clear in view of the obvious multiple exposures early in the epidemic. The best instance of transfer by a carrier involved a ward maid whose duties included the distribution of food and fluids to the post-partum patients. She was dismissed from duty as soon as the carrier state was recognized, but six days later after a single negative throat culture she returned to care for nine ante-partum patients. Five days later one woman in this group developed scarlet fever and another presented a throat culture positive for beta-hemolytic streptococci; cultures taken from the maid at the same time were again positive. All three organisms (from the maid and the two patients) were later shown to be the same. After her return to duty, the maid was required to wear a gauze mask, but it is apparent that this did not offer adequate protection to those in contact with her. It is also obvious that the single negative culture was given undue significance.

In all but two of the babies, the infection was evidently acquired from the mother during the nursing periods, but in the two exceptions, a carrier was probably responsible. In both instances the babies, which were small, were isolated in the premature nursery and had no contacts except with the attendants. The nurse-maid who prepared

and gave feedings during the night was overlooked because she was off duty at the time the cultures were taken from the night staff, but after both babies had developed evidences of infection (one died from pneumonia and septicemia) her throat culture showed beta-hemolytic streptococci. In another instance, an infected baby was responsible for the development of a carrier condition in a nurse, who had previously been negative. The nurse aspirated mucus from the throat of the baby during the terminal tracheobronchitis and then inserted her fingers in her mouth. Two days later throat cultures revealed streptococci (Type 3), but she had no clinical manifestations and became negative after treatment.

The clinical reaction to infection with any organism, including the beta-hemolytic streptococcus, depends upon the susceptibility of the host, the pathogenicity of the invading organisms, and the number of organisms attacking the host. Variations in these factors determine whether individuals repeatedly exposed during an epidemic will develop the disease, become asymptomatic carriers, or remain uninfected. Among the 84 individuals directly and repeatedly exposed, approximately 57 per cent developed some manifestation of a streptococcus infection or became carriers, while the remaining group did not acquire the infection as shown by repeated negative throat cultures and the absence of clinical symptoms.

Evidently newborn babies are somewhat more resistant to invasion by beta-hemolytic streptococci than are adults, but this immunity disappears within eight to fourteen days. Of the 33 babies directly exposed, 14 harbored the streptococci. Except in one instance, the babies of mothers who developed clinical scarlet fever showed severe upper respiratory infections. Three additional babies had mild rhinitides and four became asymptomatic carriers. The remaining infants showed no bacteriologic or clinical evidence of invasion by the streptococci. These experiences suggest that the supposed immunity of newborn children to the beta-hemolytic streptococcus has been greatly exaggerated.

SUMMARY AND CONCLUSIONS

Clinical and bacteriologic studies of an epidemic of scarlet fever and associated beta-hemolytic streptococcic infections were made during an epidemic on the obstetric wards of a general hospital. The epidemic evidently had its origin from a patient admitted with a severe upper respiratory infection acquired during an unreported contact with a relative in the prodromal stage of scarlet fever. From this focus the disease apparently spread by direct contact, and the situation was finally controlled by the adoption of strict isolation techniques.

The 675 individuals subjected to greater or lesser exposure included 210 newborn children and 465 adults. Fourteen of the infants showed upper respiratory infection; 7 of these progressed to severe tracheobronchitis, but there were no cases of scarlet fever. Among the 66 adults who harbored the streptococci, 14 had typical scarlet fever, 2 showed puerperal endometritis, 13 had pharyngitis, 5 developed rhi-

nitis, while the remaining 32 were asymptomatic carriers. Seven of the adult patients and two of the newborn infants developed various complications. There was no adult fatality, but two babies died from pneumonia following tracheobronchitis.

In general, this epidemic confirmed the general belief that the puerperal woman is more susceptible to scarlet fever and to other manifestations of beta-hemolytic streptococcic infections than is the antepartum individual. On the other hand, the common belief that the newborn child is immune to these organisms was not substantiated.

REFERENCES

(1) *Allan:* 1905. Quoted by Dorner. (2) *Bohn:* 1877. Quoted by Dorner. (3) *Boxall:* 1888. Quoted by Dorner. (4) *Burton, A. H. C., and Weir, J. H.:* Lancet **1:** 1110, 1936. (5) *Byers, J.:* Brit. Med. J. **2:** 118, 1912. (6) *Coffey, J. M.:* Am. Pub. Health Assn. Year Book, p. 159, 1935-36. (7) *Idem:* Ibid. p. 135, 1936-37. (8) *Colebrook, D. C.:* The Source of Infection in Puerperal Fever Due to Haemolytic Streptococci, Medical Research Council, Special Report Series, 205, H. M. Stationery Office, London, 1935. (9) *Dorner, G.:* Deutsche med. Wchnschr. **46:** 734, 1920. (10) *Griffith, F.:* J. Hyg. **34:** 542, 1934. (11) *Olshausen, R.:* Arch. f. Gynäk. **9:** 169, 1876. (12) *Rominger, E.:* München. med. Wchnschr. **66:** 437, 1919. (13) *Sédallian, P.:* Rev. d'hyg. **57:** 481, 1935. (14) *Tillett, W. S.:* Bacteriol. Rev. **2:** 161, 1938. (15) *Watson, B. P.:* Am. J. Obst. & Gynec. **16:** 157, 1928.

DISCUSSION

DR. FRED L. ADAIR, Chicago, Ill.—It is a well-known fact that one attack of scarlet fever seems to protect actually or relatively against a subsequent attack of this disease. This brings up the question of whether an attack of scarlet fever might protect against other types of streptococcic infection. Some years ago a study was carried out in which we found that women who had had scarlet fever were less susceptible to puerperal infection than those who had not had scarlet fever.

It also brings up the question of whether the pregnant woman with scarlet fever transmits the infection to the newborn child. So far as we have been able to find, there are no cases in the literature where the streptococcus has been found in the fetus born of a mother who had scarlet fever during pregnancy. Cases are reported where the newborn baby had a rash. There are two possible explanations: one is that the fetus actually had a streptococcic infection, and second, that the fetus may have erythrogenic toxins which produced a rash without having an actual infection.

It is hardly fair to conclude that because a woman or child has an infection with beta hemolytic streptococcus it is scarlet fever, and she is going to develop a rash. The rash may be due to one or two factors. The organism may have unusual capacity to produce erythrogenic toxins which account for the rash, or the host of the streptococcus may have a peculiar susceptibility in the way of an allergic reaction which may account for the development of a rash in that particular person. The main thing to consider is that we are dealing with streptococcic infection, and its clinical manifestations in the presence or absence of a rash are not so important.

I think one might conclude from Dr. Plass' observations that the newborn infant is susceptible to streptococcic infection but is not too prone to develop erythrogenic symptoms. In other words, the skin reaction of the newborn baby to beta hemolytic streptococcus is somewhat different from that of the adult.

DR. PLASS (closing).—The clinical problem involved in carriers is to detect them. It is obviously impossible in a large service to culture the throat of every woman and yet we know that from 5 to 10 per cent of the population may harbor beta hemolytic streptococcus. I believe that the laissez-faire attitude which we have always adopted is about all we can do.

THE TREATMENT OF BACTERIEMIAS WITH SULFANILAMIDE*

JAMES R. REINBERGER, M.D., MEMPHIS, TENN.
(From the Department of Obstetrics, University of Tennessee)

THE treatment of puerperal bacteriemia has been, until recently, an almost unsurmountable problem. The lack of a universal bacteriologic and pathologic nomenclature has retarded fruitful discussions concerning morbidity, mortality, and end results from various forms of therapy.

For the past ten years the Department of Obstetrics, University of Tennessee, has been interested in accumulating such information as would serve as a basis for future bacteriologic and pathologic classifications as well as for standard therapy of puerperal infections. With particular reference to patients having positive blood cultures, I have analyzed these findings to date; but since this group of patients was entirely too small to formulate any foundation for permanent guidance, it was decided that if similar studies from other institutions could be obtained much could be gained by comparative study.

Eighty-one questionnaires were sent out to institutions accredited by The American Board of Obstetrics and Gynecology for the training of interns and residents. Questions submitted were:

1. Outline of bacteriologic nomenclature.
2. Outline of pathologic nomenclature with special reference to definition of terms: septicemia and bacteriemia.
3. Total number of patients having positive blood stream infections during 1927 to 1937 inclusive, with organisms isolated.
4. A brief outline of therapy used in above cases with end results obtained with each type of therapy, and if possible, grouped by years with therapy above cases.
5. End results of all cases grouped. A. Before sulfanilamide therapy; and B. during sulfanilamide therapy.

Thirty-three such institutions replied, but only five were able to answer the full questionnaire. Quite a large number apologized for not having sufficient time to analyze their cases of patients having positive blood infections from 1927 to 1937.

It was evident from the return questionnaires that there were no uniform bacteriologic nomenclature, at least with particular reference to the streptococcus group. All more or less conformed to Lansfield's classification.

The bacteriologic classification used in our department was suggested by the Department of Bacteriology, University of Tennessee.

*Read at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

TABLE I. BACTERIOLOGIC CLASSIFICATION OF UNIVERSITY OF TENNESSEE

Usual Organisms Found in Puerperal Infection

1. Streptococcus:
   - Alpha viridans
   - Beta (Hemo.)
     - (a) Human organisms—pathogenic to man, 30 subgroups
     - (b) Mastitis in cows
     - (c) Pathogenic to lower animals
     - (d) Cheese
     - (e) Milk
     - (f) Causes purulent respiratory infection in man
     - (g, h, k) Not pathogenic to man

Gamma, nonhemo., anaerobic organisms

2. Staphylococcus hemolytic and nonhemolytic
3. *B. welchii*
4. *B. coli*
5. Gonococcus
6. Pneumococcus
7. *B. diphtheria*

Organisms Found in Our Series 1927-1937

Hemolytic streptococcus	34 cases
B. welchii	9 cases
Pneumococcus	5 cases
Staphylococcus	3 cases
B. coli	3 cases
Nonhemolytic strep. (anerobic)	2 cases
Influenza	1 case
Total	57 cases

This analysis reveals that the hemolytic streptococcus was found in 34 of 57 cases, or 69.5 per cent. The nonhemolytic type occurred in only 2 cases.

Total blood cultures compiled from all questionnaires are grouped to compare with our series.

TABLE II. COMPARATIVE STUDY OF ORGANISMS FROM OTHER INSTITUTIONS 1927-1937

	J. ROSENHEIM BROOKLYN	E. D. PLASS U. OF IOWA	N. MILLER U. OF MICH.	MC NEILE U. OF S. CALIF.	H. F. BECKMAN U. OF IND.	TOTAL
Streptococcus	4	8	6	19	3	40
B. welchii				3		3
Pneumococcus				4		4
Staphylococcus	3	1	2	5	3	14
B. coli	2	1	1	2		6
Nonhemolytic strep.	2	2	1	1	3	9
Staph. viridans	1	1	1	1		4
Parathyphoid			1			1
Total	12	13	12	35	9	81

The hemolytic streptococcus was approximately in the same proportions as in our series. It occurred in 40 out of 81 cases, or 49.3 per cent. The nonhemolytic streptococcus occurred in 9 cases. The remaining number in either series did not suggest any significance for comparative study.

It was apparent from the study of organisms isolated from both groups that hemolytic streptococcus accounted for the largest number of patients infected. In both groups, the hemolytic streptococcus accounted for 74 out of the total of 138 cases of 53.6 per cent studied. Therefore, the hemolytic streptococcus accepted by the profession, as having been introduced from without, is still the problem to overcome.

In general, the replies to the pathologic nomenclature conformed to the one used in our department: i.e., (1) endometritis, (2) parametritis, and (3) peritonitis. But blood stream invasion, termed septicemia or bacteriemia, was not in harmony.

The definition for septicemia and bacteriemia, returned through these questionnaires, varied anywhere from saying, "The condition is the same and the terms are interchangeable" to complete omission of these terms and in their place the adoption of "puerperal infection." Several stated, "A bacteriemia indicates a mild type of infection with a transcient passing of organisms into the blood stream with no other evidence of infection"; others note, "Septicemia indicates a definite source of infection in local or remote parts of the body with or without positive blood cultures."

Unless positive evidence is presented to substantiate the real pathology, such differences in opinion preclude any possibility for unity of thought. Our department has abandoned the term septicemia, and designates all patients having positive blood stream infections as a case of bacteriemia. We feel that more patients will show positive blood cultures if close attention is devoted by the clinician to the proper time of taking blood cultures and if a more diligent search is made by the bacteriologist.

It is thought that the period of gestation and the method of termination might have some bearing on the number of bacteriemias.

TABLE III. BACTERIOLOGIC CLASSIFICATION WITH RELATION TO PREGNANCY TERMINATION

	TERM		ABORTION		UNDELIVERED		TOTAL
	OPER.	SPONT.	IND.	SPONT.	PNEUMONIA	PYELITIS	
Hemolytic streptococcus	5	13	9	7	0	0	34
B. welchii	6	2	0	1	0	0	9
Pneumococcus	0	1	1	1	2	0	5
Staphylococcus	2	1	0	0	0	0	3
B. coli	1	1	0	0	0	1	3
Nonhemolytic streptococcus	0	1	0	1	0	0	2
Influenza	0	1	0	0	0	0	1
Total	14	20	10	10	2	1	
	34		20		3		57

To our surprise, the streptococcus was found present in more spontaneous deliveries than in those by operative interferences. Moreover, there was only a negligible difference in the numbers of infections resulting from criminal or spontaneous abortion. However, the Welch's bacillus was found, most often in operative cases.

I would not attempt to sponsor such reasonings as this analysis reflects; for it is generally accepted that the hemolytic streptococcus is nearly always introduced from without.

The general trend of therapy from all questionnaires conformed with us by giving general supportive measures, occasionally serum; but all stressed repeated blood tranfusions. Sulfanilamide was used in such a small group of cases that no comparison of the end results with this drug could be analyzed. Some suggested that its use has lessened the number of positive blood stream infections; while others having had no experience, thought its use would prove of great value.

In our patients the administration of sulfanilamide has proved most advantageous. In the beginning, this drug was rather indiscriminately used in all of the more severe types of infections. Continued observation and study revealed that it would be given only in those cases presenting severe sepsis or positive blood cultures, and this, under constant surveillance. Moreover, its early administration inhibits obtaining the organisms causing the infection. The initial dose is usually fairly large, ranging from 80 to 120 gr. This massive dose serves to raise the blood sulfanilamide content to about 10 mg. in the first four hours. Subsequent doses range anywhere from 20 to 40 gr., four times a day for the first three days, and then are administered in accordance with the reduction of temperature and the amelioration of symptoms. Experience has demonstrated that this drug may act as a two-edged sword; while proving beneficial in most cases, it has produced death.

CASE 1.—(13298.) A colored female, aged 31 years, para ii, gravida iii, at full term, was admitted to the hospital on Dec. 30, 1938, apparently in early labor. A bag was inserted after thirteen hours of labor because of fetal distress. After eighteen hours the bag was expelled, and a normal delivery followed. The patient was immediately placed on sulfanilamide because of a post-partum rise of temperature of 102° F. with a pulse of 120. Red blood count was 4,050,000 with a Hb. of 9 Gm. The abdomen was tender over the uterus and there was a foul lochia. After six days, the patient gradually became semistuporous. The temperature had risen to 101° F. with a pulse rate of 120. The respiratory rate was labored and had increased to about 30 with occasional attacks of hiccoughs. Marked cyanosis was present. A daily dose of 120 gr. of sulfanilamide had been given and a total of 720 gr. was received without a check on blood sulfanilamide. The red blood count had dropped to 3,750,000, the hemoglobin content was 11 Gm., and the blood sulfanilamide 11 mg. Because of the apparent intoxication and susceptibility to sulfanilamide, the drug was discontinued. Despite this removal, the methemoglobinemia continued to rise and within a few hours was 27 per cent. Methylene blue was administered to offset the accumulation but failed when the methemoglobinemia rose to 42 per cent within forty-eight hours. The patient died on the eighth day of her illness, Jan. 8, 1939. Dr. Wendel had no explanation for this increased rise in the methemoglobin after the discontinuance of sulfanilamide.

The estimation of the blood sulfanilamide content level should have daily observations made, for quite often in some cases small dosage with less toxic symptoms will bring desired results, while in others the blood sulfanilamide content remains exceedingly low and not the sufficient level to overcome the infection, but only causing destruction

of cells and hemoglobin content. Moreover, it is necessary to have large quantities of blood available in the form of a "blood bank."

CASE 2.—A colored female, aged 34 years, para vii, gravida viii, was admitted to the hospital on May 10, 1939, with the history of having passed one quart of blood, four days before admission. This painless bleeding was later associated with lower abdominal pains, passage of clots, and dizziness. When bleeding reoccurred several days later, a private physician was called who did a vaginal examination. This was followed by profuse bleeding, and the patient was immediately sent into our service. Physical examination revealed the patient in mild shock with blood pressure 90/70, red blood count 2,390,000, hemoglobin 9.75 Gm., temperature 102° F., and the pulse 100. A vaginal examination of this full-term gravid patient revealed a placenta previa which had been perforated before admission to hospital. There was a foul vaginal discharge. Since no bleeding was present, it was decided to combat infection by large doses of sulfanilamide and blood transfusions. An intraovular bag was inserted through a 5 cm. dilated cervix after thirty-six hours of above treatment. The bag was expelled, and a dead, macerated fetus was delivered by version and extraction. The subsequent course of the disease was one of severe sepsis. The 14 blood cultures taken were always positive except for the one taken before and immediately following delivery. Multiple lung abscesses developed in spite of the heroic therapy of 886 gr. of sulfanilamide and 25 transfusions, totaling 12,500 cm. of blood. Patient died on the sixty-eighth day of her illness (July 18, 1939). Table IV outlines the abstracted case.

TABLE IV

NO. DAYS	RED CELLS AV.	Hb AV. GM.	SULFANILAMIDE			CULTURE	METHEMOGLOBIN	BLOOD GIVEN CM.
			AV. GR. DAILY	TOTAL GR.	BLOOD CONTENT			
Predelivery								
1½	2,755,000	9.0	93	140	3.0	Neg.		T. 2,100
Postdelivery								
6	2,473,000	9.0	51	448	4.5 6th day 11.2	Pos.	37% sixth day 4 plus cyanosis methylene blue started	Av.* 341 T. 2,150 Gt 4,250
4	2,150,000	8.2	60	668	4.5		Under methylene blue fell to 20% with abatement of cyanosis	Av. 225 T. 900 Gt 5,150
3	1,750,000	5.5	60	868	4.0	Pos.		Av. 666 T. 2,000 Gt 7,150
3	2,660,000	9.0	0	868		Pos.		Av. 750 T. 2,350 Gt 9,500
4	3,420,000	13.0	0	868		Pos.		Av. 450 T. 1,800 Gt 11,300

*Av., average; T., total; Gt, grand total.

A small group of patients will develop rapid anemia that will necessitate repeated blood transfusions. This within itself is not a contraindication to the continuance with the drug. The development of cyanosis, resulting from methemoglobinemia and occasionally from sulfhemoglobinemia, should be constantly watched. The estimation of methemoglobinemia should be estimated if cyanosis develops.

Since the beginning of the use of this drug our department of Obstetrics has been fortunate in having Dr. William B. Wendel, Department of Chemistry, University of Tennessee, in constant consultation.

Dr. Wendel has recorded much research relative to the action of this drug prior to its more general use. He advocated the intravenous administration of methylene blue to overcome methemoglobinemia. This procedure has permitted us to continue sulfanilamide therapy in the face of this apparent complication. It clears the cyanosis almost immediately. Within only a few days, the blood stream is rid of the infection, and except for the remaining mildly toxic symptoms, the patient is well in a few days. The administration of this drug bids fair as an adjunct in the treatment of general peritonitis. Our experience has been limited. But one such case indicates its bacteriostatic as well as its bactericidal effect until drainage could be established through a cul-de-sac puncture.

CASE 3.—(1367.) A white female, aged 25 years, para i, gravida ii, was admitted to the hospital on Aug. 20, 1939, with the history of having missed two periods. She had passed a catheter, about six days prior to her admission to the hospital. Following this instrumentation, large clots continued until admission to the hospital. The patient was acutely ill with a temperature of 101.6° F. and a pulse of 90. The entire abdomen was very tender and markedly rigid, with signs of general peritonitis. Vaginal examination revealed bleeding and a uterus the size of a two and one-half months' pregnancy. The red blood count was 7,750,000 with hemoglobin 13 Gm.; urine negative. During the first ten days, the patient ran a septic fever between 101° and 103° F., with three chills, pulse around 140, generalized abdominal pain, and rigidity and tenderness with localization in the pelvis. Treatment consisted of 620 gr. of sulfanilamide with a reduction in the red count down to 1,750,000 and hemoglobin of 7.5 Gm. On the fifth day in spite of two blood transfusions, the patient developed a methemoglobinemia, with a blood methemoglobinemia of 22 per cent and four-plus cyanosis. Both subsided after intravenous methylene blue. A pelvic abscess was drained on the tenth day. For the next twenty-one days the patient's temperature varied from 99 to 100° F., and the pulse 90. More than 500 gr. of sulfanilamide were given. Blood transfusions and supportive treatment increased the red blood count to 3,400,000 and hemoglobin to 9 Gm. During the next twelve days the patient ran a fever from 98 to 103° F. with a daily average rise of 102 to 103° F. At this period no sulfanilamide was given. Increasing pain and tenderness developed in the lower abdomen. This showed that the abscess had reoccurred and was drained through the cul-de-sac. Recovery was rapid and uneventful.

Because of the limited use of this drug, the question relative to grouping the cases into pre-sulfanilamide therapy could not be compared. In fact, none of the patients, in the reported group of compiled cases from questionnaires, had received any sulfanilamide.

This study (Table V) demonstrates the continued high death rate, for there were 60 deaths in 81 cases, or a mortality of 74.7 per cent, against 51.1 per cent for our own series treated prior to introduction of sulfanilamide.

Our own results in a comparative tabulation reveal a general improvement in mortality figures, even before the introduction of sulfanilamide, and a striking improvement after its use (Table VI).

TABLE V. COMPARATIVE STUDY OF END RESULTS OF BACTERIEMIA 1927 TO 1937

	TOTAL CASES	CURED	DIED	PERCENTAGE DIED
Rosenheim Brooklyn	12	5	7	53.3
E. D. Plass U. of Iowa	13	6	7	55.5
N. Miller U. of Mich.	12	0	12	100
McNeile U. of S. Calif.	35	5	30	85.7
Beckman U. of Ind.	9	5	4	44.4
Totals	81	21	60	74.1

TABLE VI. END RESULTS IN BACTERIEMIA 1927 TO 1937

YEAR	MEDICATION	TOTAL CASES	CURED	DIED	PERCENTAGE DIED
1929	Blood trans. metaphen	1	0	1	100
1930	Blood trans. perf. serum	1	0	1	100
1927	Anti-strep. serum	4	1	3	75
1928	Anti-strep. serum and blood	7	2	5	71.4
1931-1935	Blood trans. and medical treatment	11	5	6	54.5
1930	Medical therapy	13	9	4	30.7
1930	Perfringes serum	3	3	0	0
1936	Blood trans. and sulfanil.	6	4	2	33.3
1937	Sulfanilamide	5	5	0	0
Totals		54	30	24	44.4

TABLE VII. COMPARATIVE STUDY

	YEARS	CASES	DEATHS	PER-CENTAGE
Pre-sulfanilamide				
Colebrook	1932-1935	82	55	70.7
Reinberger	1927-1935	43	22	51.1
Sulfanilamide-prontosil, etc.				
Colebrook	1936-1937	22	6	27.3
Reinberger	1936-1937	11	2*	18.1

*Both patients admitted in moribund state, and inadequate treatment was administered –10 and –20 gr., respectively.

Likewise a comparative study (Table VII) was made of our series with that of Colebrook's of England.

The mortality for the entire 57 patients, including those treated by sulfanilamide, was 44.4 per cent. Excluding those treated by sulfanilamide, the mortality was 51.1 per cent. The mortality following the use of sulfanilamide was reduced to 18.1 per cent. Colebrook's figures in the pre-sulfanilamide group had a mortality of 70.7 per cent; our series, a mortality of 51.1 per cent. Colebrook's patients treated with sulfanilamide had a mortality of 27.3 per cent; ours 18.1 per cent. A review of the two deaths in our small series of 11 cases revealed inadequate treatment; for only 10 and 20 gr. were given, respectively. It is almost unbelievable that such immediate results were achieved with this comparatively new drug.

SUMMARY

1. Puerperal bacteriemia is more common than generally recognized.

2. During the period of this study 1927 to 1937, 15,000 patients were delivered.

3. There were 54 patients with positive blood stream infection, an average of 3.5 per cent per 1,000.

4. Hemolytic streptococcus accounted for 34 out of 54 organisms isolated.

5. There were 24 deaths out of 54 cases, mortality 44.4 per cent.

6. This study indicates that there has been a gradual, if not actual, reduction in ratio for type of therapy.

7. Sulfanilamide alone or with transfusion seemed to offer a sense of security, which otherwise has been absent; in that among the last 9 patients treated with this drug, there were no deaths.

CONCLUSIONS

1. The high death rate from puerperal bacteriemia, despite the advancement of scientific medicine, indicates that there is considerable room for improvement.

2. A clearer conception of the bacteriology and pathology will aid materially; however, more can be accomplished by prophylactic measures.

3. The avenues of invasion and multiplicity of the sources of infection in the parturient canal by the hemolytic streptococcus must be recognized.

4. Blood transfusion and sulfanilamide bids fare to out-distance any remedies heretofore applied.

DISCUSSION

DR. R. T. LAVAKE, MINNEAPOLIS, MINN.—To aid in the preparation for this discussion, Dr. James F. Shandorf went over all cases of clinical sepsis treated with sulfanilamide since the first of the year at the University Hospital. There were 57 cases in all, including 42 septic abortions and 15 cases of clinical postpartum sepsis. All recovered but two. All of these also received as many transfusions as were deemed indicated. In only two of these did the cultures return positive for *Streptococcus hemolyticus*, namely, in two cases of abortion, which ended fatally. One of these patients was brought in practically moribund and died five hours after admission; and the other died on the fourteenth day.

Our immediate use of sulfanilamide therapy upon a clinical diagnosis of sepsis, is only a trial, in the endeavor to get the full bacteriostatic action of the drug as early as possible in case a *Streptococcus hemolyticus* is later identified by culture. Whether or not we will continue to feel justified in beginning sulfanilamide therapy before actually obtaining positive cultures of *Streptococcus hemolyticus* will depend upon further experience.

In none of our cases did a toxic reaction demand withdrawal of the drug. This is not, however, in accord with the general experience at the University Hospital. Here the drug had on various occasions to be withdrawn for the following indications: delirium and psychosis, 5 times; toxic fever, 4 times; acute hemolytic anemia, 11 times; jaundice and signs of severe hepatitis in urine and blood, 20 times. Most of these toxic manifestations cleared up under immediate withdrawal of the drug, forced fluids, and blood transfusions when indicated. From our immediate colleagues, we have also had reports of toxic agranulocytosis, peripheral

neuritis, and exfoliative dermatitis that have proved to be very serious complications. A very sobering and insistent question continually obtrudes itself in the consideration of sulfanilamide therapy and that is: What permanent pathology is likely to follow from a drug which can cause such immediate signs of serious damage? Sulfanilamide therapy should have the backing of adequate consultation and the consent of the family.

DR. H. CLOSE HESSELTINE, CHICAGO, ILL.—Colebrook's study, which is probably the largest single one yet published, indicates that the value of this drug is a very limited one. Its value in hemolytic streptococcic infection is established. It seems worthy of trial as well in *B. welchii* infection. At the Chicago Lying-in Hospital our figures indicate that the anaerobic bacillus is unyielding to sulfanilamide. It is neither sane nor judicious to use sulfanilamide indiscriminately. Mortality and morbidity are potential dangers from this therapy. Perhaps residual damage is more common than supposed.

DR. GEORGE KAMPERMAN, DETROIT, MICH.—We have seen cases where we thought that the giving of sulfanilamide in itself caused a continuation of the temperature. We have had a few cases where results were not being obtained and sulfanilamide was stopped. Immediately after that the temperature dropped.

GRANULOMA INGUINALE (GRANULOMA VENEREUM) OF THE CERVIX*

AN ANALYSIS OF THIRTY-EIGHT CASES

RUPERT E. ARNELL, M.D., F.A.C.S., NEW ORLEANS, LA., AND
JESSE S. POTEKIN, M.D., CHICAGO, ILL.
(From the Department of Obstetrics and Gynecology, School of Medicine, Louisiana State University, and Charity Hospital of Louisiana at New Orleans)

IN THE two-year period ending July 1, 1939, we have been able, by the utilization of various histologic techniques and staining methods, to demonstrate the specific histopathology of granuloma inguinale in 21 patients with granulomatous lesions of the cervix. Our success in these cases stimulated us to review the sections in all cases of cervical granuloma which had occurred at Charity Hospital of Louisiana during the preceding eight years, and as a result of this attempt it was possible to identify characteristic Donovan bodies in 17 additional cases.

We do not believe, however, that an incidence of 38 cases over a ten-year period by any means represents the true incidence of granuloma inguinale of the cervix in this institution. More serious attempts at diagnosis would undoubtedly have revealed a far greater number of cases. We are convinced that many large, exuberant cervical lesions, which simulate cancer in appearance but are never confirmed as such, are really granuloma inguinale. These lesions have remained undiagnosed in the past because adequate diagnostic methods were not employed, and they will continue to be undiagnosed in the future if such methods are not fully utilized.

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

HISTORIC

Since McLeod[1] first described granuloma inguinale in 1882, numerous reports dealing with its clinical and pathologic aspects have appeared in the literature. D'Aunoy and von Haam,[2] in a recent extensive review of the subject, were able to collect 251 cases, to which they added 294 of their own. They feel that the condition is endemic in the South, and state that the problems of its diagnosis and epidemiologic control are far from being solved.

Gardner,[3] in 1928, was the first to suggest that the exuberant granulomatous ulcerations of the cervix, nonmalignant in character, which had been described by several investigators might be related to granuloma inguinale. Six years later McGee[4] reported eight such lesions from Charity Hospital of Louisiana. He pointed out that the clinical appearance and histopathology in these cases were strongly suggestive of granuloma inguinale, and that their favorable response to tartar emetic therapy was identical with the response of true granuloma inguinale to this type of treatment. He was unable, however, with the staining methods at his disposal, to demonstrate Donovan bodies in the tissues, and he was therefore forced to classify the cases as nonspecific cervical granulomas. It is interesting to note that by the use of the improved staining methods available to us, when we began our study, we were able to demonstrate Donovan bodies in four of McGee's eight cases, and so to confirm the diagnosis of granuloma inguinale which he had suggested.

In 1937, by the report of two proved cases, Pund and Greenblatt[5] established granuloma inguinale of the cervix as a distinct clinical entity. Since then, so far as we have been able to ascertain, 12 additional cases have been reported in the literature.[6, 7] Our own experience, as we have already intimated, has convinced us that this lesion is by no means as infrequent as the small number of reported cases would lead one to believe. Indeed, we are convinced that a more frequent recollection of the condition, with a more general use of biopsy and of a careful staining technique, would reveal the diagnosis in many suspicious lesions of the cervix.

PATHOLOGIC ANATOMY AND HISTOLOGY

It is now generally agreed that granuloma inguinale should be regarded as a venereal infection, even though extragenital lesions have been described, including one instance of involvement of the larynx and another of involvement of the bowel.[8-10] In the female the usual site of predilection is the skin and subcutaneous tissues of the external genitalia and of the perineal and inguinal regions.

D'Aunoy and von Haam, on the basis of their analysis of their 545 collected and personal cases, divided the lesions into five principal groups, according to the clinical appearance and histopathology. They also concluded that the disease is a strictly local infection, with no dissemination of the infectious agent and no toxic manifestations unless secondary infections occur. Such secondary infections, they point out, must always be regarded as very serious.

The Donovan body, which is the specific etiologic agent in granuloma inguinale, is a microorganism which probably belongs to the protozoan group, although there is some evidence to suggest that it may be a fungus. It is pathogenic only for man and is transmitted only by direct contact. It has never been cultured. The incubation period is thought to be forty to sixty days.[11]

The lesion of granuloma inguinale of the cervix appears first as a soft, red, granular macule (Fig. 1). It enlarges rapidly and sometimes ulcerates early, forming a shallow, granular ulcer with well-defined edges. Sometimes it develops as a hypertrophic granular mass in which are numerous small areas of ulceration. In advanced stages the entire cervix may be replaced by a large cauliflower mass of soft, friable bleeding tissue (Fig. 2). The cervical lesion may extend to the adjacent vaginal walls and may completely fill the vaginal vault, or, occasionally, may be combined with only a few discrete vaginal lesions, or even a single lesion.

Microscopic examination of the lesion reveals characteristic exuberant granulation tissue in which the pathognomonic cell is found. There is an abundance of loose

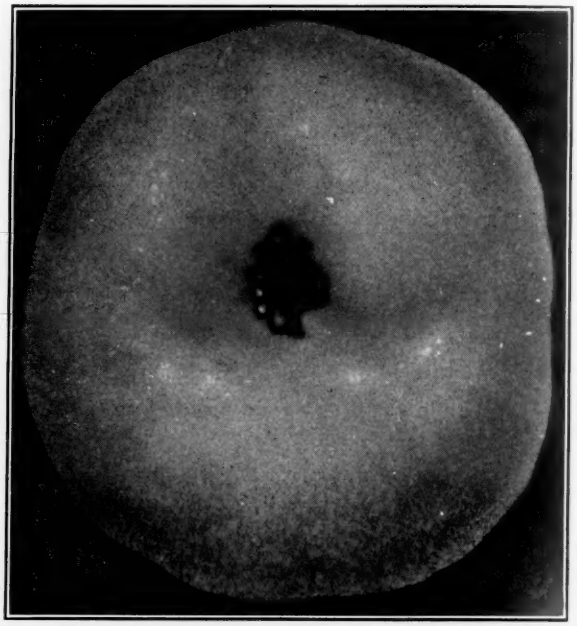

Fig. 1.—Early granuloma inguinale of the cervix. Note the close resemblance of the lesion to a cervical erosion.

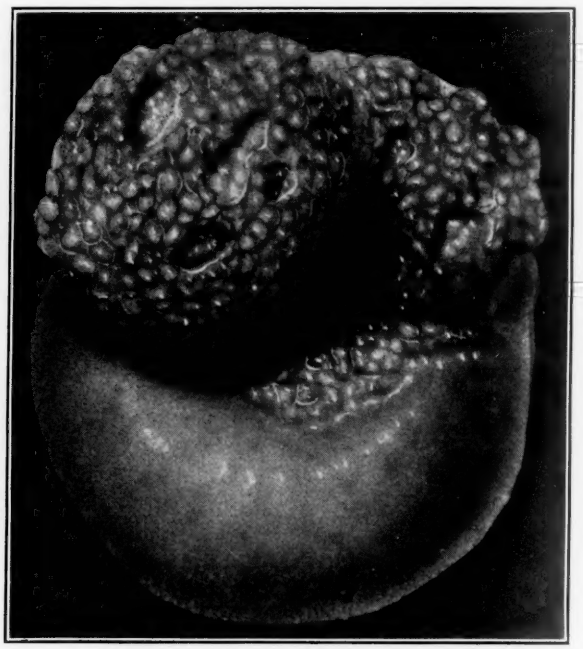

Fig. 2.—Advanced granuloma inguinale of the cervix, consisting of a large cauliflower mass of soft, friable, bleeding tissue. Note the close resemblance of the lesion to cervical malignancy.

connective tissue in which are many young blood vessels. The lumina of these vessels may be completely filled with polymorphonuclear leucocytes. The granulation tissue is interspersed with large numbers of plasma cells and a diffuse infiltration of polymorphonuclear leucocytes, which often appear as large, dense collections. There is usually a relative absence of lymphocytes.

The essential feature of the histopathology is the presence of large monocytes with many intracytoplasmic spaces in which the Donovan bodies are dispersed. These bodies, which are elliptical or round and stain deeply, are usually arranged peripherally in the intracytoplasmic spaces. Sometimes, however, they are scattered through the cell, or appear as one or more collections, pushing the nucleus to the side. Sometimes, again, the entire cell may be filled with closely packed organisms which completely obliterate the cell outline, and extracellular clusters may be visible. In addition to the Donovan organisms, various spirochetes and motile fusiform bacilli are frequently noted. Secondary invasion by other bacteria is also common (Fig. 3).

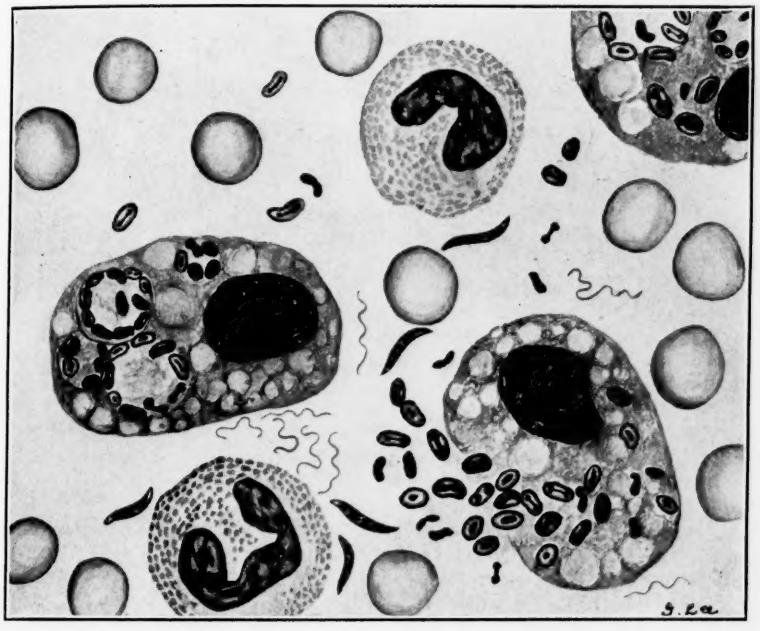

Fig. 3.—Composite camera lucida drawing (×2,000) to illustrate: *a*, Relative size and structure of typical large mononuclear endothelial cells and Donovan bodies. *b*, Characteristic arrangement of Donovan bodies around periphery of intracytoplasmic spaces of monocytes. *c*, Extracellular organisms. Note encapsulated and nonencapsulated ovoid form and intense bipolar staining reaction. *d*, Associated gram-negative, motile, fusiform bacilli and spirochetes.

ANALYSIS OF CASES

Thirty-four of the 38 patients were colored and only 4 white, these figures being in agreement with the high proportion of negroes with granuloma inguinale of the external genitalia reported in the literature. Apparently these are the first cases of cervical granuloma inguinale to be reported in white women. The predilection of the disease for the negro race is probably to be explained by the difference in sex hygiene and moral standards in the colored and white races, since promiscuity in sex relations and unhygienic conditions of the genital organs have been established as contributory or predisposing causes of granuloma inguinale.

Thirty-one patients were between 20 and 40 years of age, which is the period of maximum sexual activity. The age range was from 18 to 62 years; the oldest and youngest patients were negroes.

Thirty-four patients had had from one to 12 pregnancies, and 26 had had more than 3. Only 2 had never been pregnant. Parity seems to enhance susceptibility to this infection, and the increased vascularity of the tissues during gestation, plus the added trauma of labor, seems to stimulate the lesion to rapid growth. Three patients, however, developed their disease four, ten, and twelve years, respectively, after the menopause.

In 4 cases the diagnosis was made during gestation. One of these patients aborted at two and one-half months. In the other 3 cases the lesions enlarged rapidly during the last trimester of pregnancy and in the early puerperium, and the response to therapy was poor. Five patients had extensive involvement of the cervix, associated with marked symptoms, within six weeks after parturition, and another presented herself within three months, with a cervical growth which filled the entire vaginal vault. In these 6 cases, the cervix was apparently normal during pregnancy.

A purulent or bloody vaginal discharge, hemorrhage, and pelvic pain were the chief complaints for which the patients sought relief. The earliest symptom was usually a serous discharge, followed successively by purulent leucorrhea, blood-stained leucorrhea, or, in some instances, by profuse vaginal hemorrhage. Bleeding was present in 31 of the 38 cases, the prominence of this symptom being due to the tendency of the lesion toward early ulceration, with involvement of the highly vascularized cervical tissue.

Thirty patients complained of pain or discomfort in the lower abdomen, usually associated with backache. The pain was bilateral in all but four instances. Many patients exhibited parametrial and adnexal thickening and tenderness upon pelvic examination, and eight had palpable masses in the pelvis. In many, if not in most cases, the pelvic inflammatory disease was concomitant or pre-existent, and not the result of the cervical infection, for a large percentage of the colored women treated at Charity Hospital exhibit pelvic disease. In other instances the associated pelvic disease was apparently due to secondary infection of the primary cervical lesion, with lymphatic extension to the pelvis. Direct extension of the granuloma inguinale to the pelvis may also occur, with involvement of the uterus, tubes, and ovaries.[12]

Ten of the 18 patients who were hospitalized had temperatures above 100° F., and 14 had sedimentation rates of less than thirty minutes. Many were anemic and complained of weakness, thus demonstrating the effects of blood loss and of chronic infectious processes.

The duration of symptoms varied from one week to three years. Most of the long-standing cases represented untreated or chronic lesions, or perhaps recurrences, rather than re-infections. About one-half of the patients sought relief in less than a month after the onset of symptoms, apparently because of the foul-smelling, sanguinopurulent discharge which caused sufficient discomfort to force them to seek early medical consultation. The interval is unusually short for colored patients who tend to delay medical consultation whenever severe pain is not a prominent symptom.

The lesion was limited to the cervix or the cervix and upper vagina in 28 of the 38 cases, but ulcerations were also present on the cervix and vulva in 5 cases, on the cervix and about the perineum and anus in 3, and on the cervix and in the inguinal region in 1. We also observed 1 patient in whom the infection involved the cervix and vagina, the perineal and anal regions, and the inguinal region. Concomitant infections of the cervix and of other sites by granuloma inguinale are thus not rare. In 4 of the 10 cases in which other sites were also involved, the cervix seemed to be the primary site of the infection. In the other 6 cases, sites other than the cervix were involved first.

DIAGNOSIS

The differential diagnosis of cervical granuloma inguinale offers considerable difficulty and the percentage of error is high. This is not unexpected, for the symptomatology and gross appearance of the lesion closely simulate those of other diseases. In this series only 8 of the 38 cases were diagnosed correctly by clinical means. In 27 cases a tentative clinical diagnosis of carcinoma was made; the

diffuse redness and softened consistency of granuloma inguinale are significant diagnostic points in this connection, though it must also be remembered that granulomatous lesions containing large amounts of fibrous tissue may appear hard and nodular. Two cases were diagnosed as everting cervical erosions, and one was diagnosed as chorionepithelioma because of post-partum bleeding of three months' duration and the presence of a large cauliflower mass attached to the cervix, with fixation of the uterus.

In addition to the diseases already mentioned, granuloma inguinale of the cervix must be distinguished by appropriate tests and examinations from all other conditions causing granulomatous lesions of the cervix. These include lymphogranuloma venereum, chancroid, syphilis, and tuberculosis. The mixed venereal infections which are frequently present in combination with granuloma inguinale may also seriously confuse the picture. Eighteen of the 38 patients in our series had syphilis, 9 had active gonorrhea, and 4 had both diseases.

Each suspected case of cervical involvement should be studied according to the following routine:

1. Wassermann reaction for syphilis.
2. Dark-field examination for spirochetes.
3. Smears and cultures for gonococci.
4. Frei test for lymphogranuloma inguinale.
5. Intradermal antigen test for chancroid.
6. Biopsy for tuberculosis, nonspecific granulation tissue, malignancy, and granuloma inguinale.

The final diagnosis in all cases in this series was made by the demonstration of Donovan bodies in a biopsy specimen. In some 20 additional cases the gross and microscopic picture and the response to therapy were strongly suggestive of granuloma inguinale, but typical Donovan bodies could not be identified in the cervical tissues, and these cases have therefore been omitted from this analysis. No matter how suggestive the clinical and histopathologic picture may be, no case should be accepted as granuloma inguinale unless the pathognomonic cell is found.

Demonstration of the Donovan bodies, which is essential for diagnosis, is by no means a simple matter in many cases, particularly if the histologic technique employed is inadequate, or if the material examined is insufficient. Often, because of the chronicity of the lesion, only a few monocytes may be present in the sections. The monocytes may be confused with large plasma cells containing deep-staining, fragmented nuclei, and the Donovan bodies may be confused with debris. It is apparently more difficult to demonstrate Donovan bodies in material from mucous membrane surfaces than from the more usual sites in the skin and subcutaneous tissues. As we have already pointed out, no culture methods are available. These difficulties should be emphasized, for the literature is often misleading and gives the impression that the pathognomonic cells can always be easily identified, whereas actually a diligent search of many sections may be necessary before the diagnosis can be confirmed.

We have had better results by the use of tissue sections secured by biopsy than by the use of scrapings or smears. The biopsy should include the base of the lesion, for often necrosis and secondary infection in the more superficial areas obscure the specific histology. We also prefer formalin-fixed paraffin sections to celloidin sections or frozen sections. Dieterle's[13] silver stain, in our experience, is the most accurate of the various staining techniques. Donovan bodies have a marked affinity for silver salts and often can be demonstrated readily by this method while remaining persistently invisible by other staining techniques. It is usually possible to demonstrate them by hematoxylin and eosin staining and by Wright's stain, with Zenker fixation, although they are often considerably less distinct, we have found, when these methods are used.

THERAPY

Antimony compounds are considered specific in granuloma inguinale and should be employed routinely, although, if special indications are present, it may be necessary to employ other measures also. We personally prefer tartar emetic to fuadin. It is given intravenously twice or three times a week, in doses of 10 c.c.

of 1 per cent solution. Local therapy is also advised in all cases. We have had the best results with topical applications of neoarsphenamine (4.5 per cent) in glycerine to combat fusospirochetosis and secondary infections and to promote healthy granulation tissue. We also employ potassium permanganate irrigations (1:1000 solution) to alleviate local irritation and to overcome the odor of the discharge.

Of the 27 patients in this series who were placed on tartar emetic therapy, 6 failed to continue treatment and were lost sight of. Of the 21 who received adequate treatment, 17 exhibited healthy cervices when treatment was discontinued. In most cases clinical improvement was noted within three to four weeks after treatment was begun. In one instance cure was effected by four injections of tartar emetic given over a four weeks' period, but the average duration of treatment was three months. The longest course of treatment was fourteen months.

It is most important that treatment be continued long enough to effect a permanent cure; the tendency is to discontinue it when signs of superficial improvement are evident. Chronic lesions are often resistant to therapy, but early lesions usually respond rapidly, and prompt diagnosis is therefore essential to a rapid cure. In a few cases spontaneous cures may follow the control of secondary infections by topical applications, but this is not usual. Recurrences with any form of therapy are unfortunately common.

Five patients in our series, one of whom had previously failed to respond to tartar emetic therapy, had large, fungating cervical masses which were treated by excision of the mass with the actual cautery knife, or the electrosurgical unit preliminary to intensive treatment with tartar emetic. When these methods are used, it is important that the line of excision should extend well beyond the infected tissue. Bleeding is readily controlled by coagulation of the base of the lesion.

Two patients were treated with deep x-ray therapy and both responded rapidly, but failed to continue treatment and no follow-up data are therefore available. We have gained the impression, however, that this method deserves a more extensive trial. One patient, who had fibroids of the uterus and pelvic inflammatory disease also, was treated with tartar emetic for two months, and then was submitted to complete hysterectomy and bilateral salpingo-oophorectomy. Pund and Gotcher[12] have reported a somewhat similar case in which sections of the uterus and adnexa revealed characteristic Donovan bodies, but in this case they were found only in the cervix.

At the present time we are treating a patient with granuloma inguinale of the cervix by sulfanilamide, using the drug orally and applying it locally as a heavy coating of powder. The results have been striking and seem to justify a further careful trial of sulfanilamide therapy.

The therapy of granuloma inguinale of the cervix during pregnancy demands a special note, for, as we have already stated, the response to tartar emetic therapy is poor. Large growths may complicate labor and introduce serious hazards of hemorrhage and infection. Delivery from below should always be employed if it seems safe. If, however, the cervical growth is extensive or if concomitant lesions of the external genitalia have produced so much scar tissue that vaginal delivery seems unwise, Porro cesarean section may be necessary. We are at present observing a patient who will require this operation, because the large masses of granulomatous tissue in the perineum, vulva, and vagina will make delivery from below impossible.

The obvious maternal hazards of granuloma inguinale in pregnancy should not blind us to the child's risk. Dr. J. K. Howles[14] has recently brought to our attention a case in which, presumably, the disease was transmitted to the baby during delivery. The mother, a negro woman, had extensive granuloma inguinale of the vulva and perineum, and six weeks after delivery the baby was observed to present the same condition at the umbilicus. The lesions were extremely resistant to treatment, and cure was not effected until some eighteen months had elapsed. We had not previously considered the possibility of such transmission, but there seems no reason, upon reflection, why under these circumstances granuloma inguinale should not be transmitted by contact as readily as gonorrhea is. We do not recollect having seen this possibility mentioned anywhere in the literature on the subject.

MORTALITY

Two of the 38 patients died, a mortality of 5.2 per cent. One, in the early years of this study, was treated by local acetone applications, to which she did not respond. She continued to bleed from the vagina and became progressively weaker until death. The other patient was treated by the application of 4,800 mg. hr. of radium. She was discharged from the hospital as improved, but died shortly afterward of profuse hemorrhage from the cervix. Both these deaths make it clear that granuloma inguinale should not be considered an innocuous disease, and make clear also the importance of early diagnosis and adequate therapy.

CASE REPORT

The following case report is cited as typical:

L. G. (No. 57238), a colored woman 23 years of age, para iii, was seen in the Outpatient Clinic of the Charity Hospital of Louisiana at New Orleans, June 21, 1938. She complained of a bloody vaginal discharge and of low abdominal pain of four weeks' duration. Her last pregnancy had terminated ten months previously.

Fig. 4.—Biopsy section of cervical lesion (Case 57238) stained by the silver impregnation method of Dieterle. The exuberant granulation tissue contains pathognomonic cells with Donovan bodies in circular arrangement about intracellular cysts. Dark-staining, rodlike, Donovan bodies are dispersed in other cells but are not readily identified in this focus.

The whole cervix was found to be diffusely reddened. The upper lip was almost entirely replaced by an exuberant mass of soft, granular tissue which bled easily on manipulation. On pelvic examination the uterus was normal in size and position, but was somewhat tender on movement. Both adnexal regions were tender to palpation, and a soft mass, 5 cm. in diameter, was palpated in the right adnexal region.

The patient's temperature on admission was 99.4° F. The red blood cell count was 3,100,000 and the hemoglobin 70 per cent. The Wassermann and Kahn reactions were negative. Smears from the cervix and urethra revealed no gonococci, and the Frei antigen test was negative. The sedimentation time was ten minutes.

The tentative diagnosis was subacute pelvic inflammatory disease and granuloma inguinale of the cervix. Biopsy of the cervix revealed characteristic Donovan bodies (Fig. 4).

Treatment consisted of the intravenous injection of 10 c.c. of 1 per cent solution of tartar emetic twice weekly, combined with topical applications of 4.5 per cent neoarsphenamine in glycerin. At the end of three weeks there was a decided

improvement in the appearance of the cervix, and the pelvic pain was somewhat decreased. The cervical lesion became progressively smaller, and clinical improvement was steady. At the end of the eighth week of treatment the cervical lesion had disappeared entirely, and examination ten months later revealed a normal cervix.

SUMMARY

1. Thirty-eight cases of granuloma inguinale of the cervix were observed at Charity Hospital of Louisiana during the ten-year period ending July 1, 1939, 21 of the number being identified within the last two years. Four of the patients were white, and represent the first instances of this disease to be reported in white women.

2. The clinical and histopathologic features of the lesion are discussed. The diagnosis is dependent upon the demonstration of the pathognomonic cell-containing Donovan bodies, which are most readily identified by the use of fixed biopsy material and the silver impregnation method of Dieterle.

3. Carcinoma of the cervix is easily confused with cervical granuloma inguinale, and 27 of the 38 cases in this series were so diagnosed. The close clinical similarity of the two conditions is responsible for the error.

4. Vaginal bleeding and pelvic pain were the outstanding symptoms.

5. Intravenous antimony therapy is the most effective form of treatment, and tartar emetic gives the best results. The duration of treatment is shortened if large growths are completely excised by means of the cautery knife before specific therapy is begun. Recurrences are common.

6. Granuloma inguinale of the cervix is a clinical entity which demands general recognition and further study. Only by these means will the true incidence be established and improved methods of diagnosis and treatment be evolved.

REFERENCES

(1) *McLeod, E.:* Quoted by D'Aunoy, R., and von Haam, E. (2) *D'Aunoy, R., and von Haam, E.:* Am. J. Trop. Med. **17:** 747, 1937. (3) *Gardner, G. H.:* In Howard Kelly's Gynecology, New York and London, 1928, D. Appleton-Century Co. (4) *McGee, W. B.:* Am. J. Obst. & Gynec. **28:** 244, 1934. (5) *Pund, E. R., and Greenblatt, R. R.:* J. A. M. A. **108:** 1401, 1937. (6) *Henthorne, J. C.:* South. M. J. **32:** 614, 1939. (7) *Torpin, R., Greenblatt, R., and Pund, E.:* Am. J. Surg. **44:** 551, 1939. (8) *Greenblatt, R., Torpin, R., and Pund, E. R.:* Arch. Dermat. & Syph. **38:** 358, 1938. (9) *Harris, R.:* Laryngoscope **40:** 707, 1930. (10) *Pund, E. R., Smith, A. D., Hicks, D. Y., and Dienst, R. B.:* South. M. J. **32:** 917, 1939. (11) *Greenblatt, R., Dienst, R. B., Pund, E. R., and Torpin, R.:* J. A. M. A. **113:** 1109, 1939. (12) *Pund, E. R., and Gotcher, V. L.:* Surgery **3:** 34, 1938. (13) *Dieterle, R. R.:* Arch. Neurol. & Psychiat. **18:** 73, 1927. (14) *Howles, J. K.:* Personal communication.

DISCUSSION

DR. EDWIN L. ZANDER, New Orleans, La.—The Charity Hospital of Louisiana at New Orleans affords a unique opportunity not only for the investigation of unusual pathology but also for the comparative study of various diseases in the negro and white races. It is not surprising, therefore, that the authors have been able to find at Charity Hospital 38 cases of granuloma inguinale of the cervix. Nor is it surprising, in view of the predilection of other forms of this disease for the colored race, that 34 of the 38 cases should have occurred in negro women.

Any clinician working in a large gynecologic clinic will see at not infrequent intervals extensive ulcerations of the cervix. A definite diagnostic routine has been set up at the Charity Hospital for the study of suspicious lesions: (1) Wassermann and Kahn for syphilitic gumma; (2) dark-field examination for chancre; (3) smears and cultures for gonorrhea and pyogenic organisms; (4) wet mounts for trichomonads and yeast; (5) skin tests for lymphogranuloma inguinale and chancroid; (6) biopsy for malignancy, tuberculosis, nonspecific infection, and granuloma inguinale.

Although antimony compounds are considered specific in treatment, I believe that there is a definite tendency for spontaneous cure if secondary infection can be controlled. The toxic effect of antimony in large doses is well known.

Dr. Arnell has shown that by careful examination granuloma inguinale of the cervix is not as rare as it was supposed to be prior to our improved methods of diagnosis and knowledge of its clinical entity.

DR. HERBERT E. SCHMITZ, CHICAGO.—I would like to add one case which demonstrates the necessity of differentiating these lesions from carcinoma of the cervix. The patient, a colored woman, aged 26, entered the Obstetrical Department of the Cook County Hospital one year ago. She was delivered by Dr. Kobak, at which time he noticed an indurating lesion of the cervix. Thinking of the possibility of carcinoma, he transferred the patient to the Tumor Service. I took a biopsy, made a clinical diagnosis of carcinoma, and had the patient admitted to the ward for radium therapy. She was given 3,500 mg. hours. She left the hospital and did not return until two weeks ago. She now has an extensive lesion, involving the entire vagina and vulva, and is in a very critical condition. Since that time six biopsies have been taken and each time Dr. Schiller has returned a diagnosis of nonspecific granuloma.

DR. EARL CONWAY SMITH, NEW ORLEANS, LA.—One immediately is reminded of the lack of information concerning the true incidence of the disease. We have begun to wonder whether all granular lesions of the cervix should be subjected to the silver stain method, or some procedure that is practical for the diagnosis of this condition.

Our attention must also be directed to the chief points in the pathologic picture of cases of granuloma inguinale, involving the external genitalia that have, for one reason or another, become chronic. Here, we find granulation tissue, secondary infection, and a very definite attempt by nature to heal the lesion. It is because of this pathologic picture that, in cases complicating pregnancy, we select the transabdominal route for delivery to avoid serious results that would follow the vaginal route.

DR. ARNELL (closing).—We have often found it difficult to demonstrate the Donovan bodies after tartar emetic has been given. In several cases it was impossible to find the Donovan bodies two weeks after therapy had been administered. It is essential to get to the base of the lesion as the superficial necrotic tissue does not contain Donovan bodies.

FURTHER STUDIES ON THE ANDROGEN THERAPY OF GYNECOLOGIC DISORDERS*

J. P. GREENHILL, M.D., AND S. C. FREED, M.D., CHICAGO, ILL.
(From the Loyola School of Medicine and the Michael Reese Hospital.)

IT HAS conclusively been shown that testosterone, the male hormone, or its derivative, testosterone propionate, is capable of inducing progestational-like proliferation of the endometrium of rabbits and rats.[1] Like progesterone it will inhibit uterine contractions induced by estrin,[2] maintain pregnancy following the excision of the ovaries, and delay parturition in the normal pregnant rat.[3] Furthermore, it is effective in neutralizing vaginal and uterine responses to estrin and is capable of completely suppressing spontaneous estrus cycles in rats and mice.[4] It is significant that testosterone propionate is four to eight times more active than progesterone in this latter reaction, being effective in doses of 0.05 to 0.1 mg. daily.[5]

Other effects have been obtained in primates by injections of testosterone propionate. Zuckerman[6] induced ovarian atrophy and endometrial involution in monkeys while menstruation was completely suppressed throughout the duration of treatment. In normal women, Hartman[7] and Papanicolaou, Ripley and Shorr[8] have obtained similar results.

It was suggested that some gynecologic disorders which on a theoretical basis should respond to progesterone, might also respond to androgenic therapy. In this regard painful breasts and dysmenorrhea first received the attention of gynecologists.

Desmarest and Capitaine[9] reported excellent results in these conditions. The ability of testosterone to suppress menses suggested its application in the treatment of excessive uterine bleeding. Loeser[10] injected doses of 50 mg. of testosterone propionate every other day to patients with menorrhagia and was able to control the flow. He maintained that about 500 mg. during the month was necessary to suppress the menstrual bleeding until the next period, while 300 mg. postponed the menses for about eight to ten days. Biopsies of the endometrium revealed that this tissue had undergone atrophy. Loeser noted also that fibromyomas decreased in size significantly under this therapy. He obtained beneficial responses also in two cases of chronic cystic mastitis and in several cases of dysmenorrhea, using somewhat smaller doses (150 to 300 mg.).

Additional information regarding the therapeutic value of testosterone propionate was reported by Foss[11] who treated 16 cases of excessive menstrual bleeding of functional origin with excellent results in most instances. The dosages which he administered were quite large, 300 to 800 mg., and he injected as much as 2,000 mg. in resistant cases. Ovulation was inhibited as indicated by endometrial biopsies. Foss noted that several patients under androgenic therapy developed hot flushes and other symptoms of the menopause. The beneficial effect of testosterone on excessive bleeding has been further confirmed by Geist, Salmon and Gaines,[12] who obtained gratifying results in 24 out of 25 cases and by Mazer and Mazer[13] who reported excellent results in uterine bleeding.

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

In a preliminary report we recorded our results in 22 patients with various menstrual disorders.[14] At that time we obtained beneficial results in patients with functional menorrhagia when the injections of 25 to 50 mg. testosterone propionate were administered during an entire month and in dysmenorrhea when the injections were given during the second two weeks of the menstrual cycle. The present paper deals with a follow-up of the patients who responded satisfactorily and includes results on 12 additional patients who have been treated recently.

RESULTS

Old Cases.—In a group which consisted of four dysmenorrheic patients who received androgen during the second two weeks of their menstrual cycle, one patient had complete relief, two had moderate, and one slight relief. The patient with complete relief experienced painful periods three months following cessation of treatment, and one of the two patients with moderate relief also complained of a return to her painful periods after several months. The other patient has had appreciable relief for almost one year.

The group of eight patients who received 25 to 50 mg. testosterone propionate for one month or longer were re-examined. One patient who was dramatically relieved of dysmenorrhea and menorrhagia due to fibroids, had normal periods for three months, then pain and bleeding returned as before therapy. The fibroid is now definitely larger than before. Another patient with severe functional menorrhagia and dysmenorrhea had eight normal periods. Then every other period became painful but not as severely as before therapy. The bleeding is again excessive but not to the degree existing before the injections.

Of the other patients in this group who responded favorably, two had endometrial hyperplasia with menorrhagia and two had small fibroids with menorrhagia. They responded satisfactorily at the time of treatment and have remained in good condition for the past seven to twelve months.

New Cases.—Twelve patients have been more recently receiving testosterone propionate.* This group consists of three patients with functional menorrhagia, one with menorrhagia and dysmenorrhea, three with menometrorrhagia, one with premenstrual migraine, and four with painful breasts preceding the menses. The patients with uterine bleeding received testosterone propionate in 25 to 50 mg. injections three times weekly for one month, and those with painful breasts and migraine were given injections only during the last two weeks of the cycle. Our results with these patients were even more satisfactory than in our preceding series. Except for one patient with menometrorrhagia all were markedly benefited immediately following therapy. Bleeding was checked effectively, several patients having normal periods for the first time in two or three years. Breasts which ordinarily caused considerable pain produced little distress whether the trouble was due to simple engorgement or to adenosis.

One of the patients, who received 350 mg. during a month, showed a considerable degree of hirsutism and acne but no lowering of the voice.

DISCUSSION

Our results confirm the observation of others that in the human being, testosterone propionate inhibits ovarian activity with the suppression of uterine bleeding and involution of the accessory sex organs, including the breasts, uterus, and vaginal mucosa. Fibromyomas, which are also under the influence of the ovary, regress. These anatomic changes persist only as long as the patient is under the influence of the andro-

*We are indebted to The Schering Corporation and to The Ciba Pharmaceutical Products for the generous supply of testosterone propionate.

gen. It is apparent that the mechanism by which testosterone propionate produces these changes is not through its progestational action, since changes typical of progesterone have not been demonstrated in the endometrium but through suppression of ovarian activity. It is not unlikely that the therapeutic results which are claimed for progesterone itself are due to this response rather than that on the endometrium. As a matter of fact, the significance of endometrial changes in ovarian dysfunction has been frequently postulated but never conclusively demonstrated for such common disorders as menorrhagia or dysmenorrhea. One may find any stage of endometrial development from the resting phase to the secretory. The fact that normal secretory endometrium is frequently found in patients with excessive menstrual flow indicates that this bleeding is not due to the lack of corpus luteum activity as is frequently postulated. Hence, the proposed therapy of this condition with progesterone is not on a sound basis. In reality, evidence indicates that relatively large doses of progesterone, amounting to 100 mg. or more in the last ten days of a cycle, are usually ineffective in controlling uterine bleeding.[17] The concept that functional bleeding is due to endometrial hyperplasia might also be abandoned, since it has been sufficiently demonstrated that hyperplasia is not as frequently associated with menorrhagia as formerly believed. In fact, hyperplasia is often seen in cases of amenorrhea or in women with normal menstrual cycles. The attempt to control excessive flow should therefore not consist primarily of attempting to alter the endometrium, since it seems quite possible that there is no correlation between excessive bleeding and histologic changes of the endometrium. It is our belief that we must look elsewhere than the endometrium for the etiology of these ovarian dysfunctions and the explanation for the therapeutic responses in these conditions.

The mechanism by which testosterone propionate influences the ovarian function in human beings has been suggested by Foss to be through its action in suppressing pituitary activity, on the basis of the endometrial changes which he obtained in the human being. Geist has considered the "modus operandi" of this substance somewhat complex and in some respects paradoxical. For instance, testosterone in primates induces ovarian inactivity and subsequent involution of the accessory sex organs, while in the rodent, it produces progestational proliferation, uterine hypertrophy, and persistent corpora lutea in the ovaries.

These seemingly contradictory findings have, however, been explained by Freed, Greenhill, and Soskin,[5] who have demonstrated a biphasic effect of testosterone propionate on the pituitary of the rat. Small amounts were found to inhibit the pituitary follicle-stimulating hormone resulting in ovarian atrophy and subsequent uterine involution due to lack of estrin. Large doses released the luteinizing hormone resulting in persisting corpora lutea and a similar suppression of estrin. The uterus underwent hypertrophy however, due to the fact that a large dose of androgen is capable of acting directly on the uterus in the absence of estrin as in the castrate rodent. It was suggested there-

fore, that the involutionary changes in the reproductive organs of human beings resembled the reaction to the small doses of androgen in the rat. The doses chosen for therapy are apparently relatively small for the human being when compared to experimental animals. The findings of Engle and Smith[15] that 25 mg., but not 5 or 10 mg., of testosterone propionate injected daily is capable of inducing a progestational endometrium in monkeys support these conclusions.

From our results and those of other workers in this field, it is not unreasonable to conclude that male hormone therapy has definitely beneficial effects in certain ovarian disorders. At the present time testosterone propionate has been used with promising results in mastopathies, menorrhagia, and dysmenorrhea.

In the treatment of dysmenorrhea and painful breasts, suppression of the menses is not necessary to obtain the desired results. It seems that complete ovarian suppression is not essential for some therapeutic responses, and it is possible that the direct antagonism of estrogen by the male hormone plays a role in the treatment of mastopathies and dysmenorrhea.

This neutralizing property of testosterone propionate has been demonstrated both in histologic responses of estrogen and in its myometrial activity. It is possible that the alleviation of dysmenorrhea is on the basis of inhibiting uterine muscle contraction. This explains the results obtained in our cases with the injection of 150 to 250 mg. of testosterone propionate in the last two weeks of the cycle wherein the pain was relieved but the menses were not disturbed. This dosage may, in certain cases, be insufficient, however, and injections during the entire month may be required in the severe cases to induce a temporary menopause in order to relieve the pain.

In the treatment of menorrhagia it seems fairly conclusive that large amounts are required so that ovarian activity is completely suppressed. We have observed several cases where sufficient testosterone propionate was administered to prevent ovulation as detected by endometrial biopsies, but this did not prevent or delay the menses significantly. In our limited experience, ovulation can be inhibited with approximately one-half the amount necessary to suppress menstruation (anovular menstruation).

While it is apparent that testosterone propionate has an effect on the pituitary gland and ovaries, it is still not understood why beneficial responses often continue following cessation of testosterone propionate injections. The explanation must await further investigations as to the mechanism of menstruation and the etiology of menstrual disorders. It is difficult to conclude from our small series how lasting the results will be; but it is our impression that the results have been fairly satisfactory from the standpoint of permanence. We will be in a better position for more definite conclusions after following the results obtained more recently.

From a practical standpoint, it is apparent that though moderate doses may frequently be effective, doses of at least 300 to 500 mg.

throughout a period of a month are often necessary in menstrual disorders, especially in menorrhagia and somewhat less in mastopathies. It is quite probable that the obstacles to administering these large doses will soon be overcome with the progress now being made in the chemistry of androgens.

Caution should be exercised in administering testosterone propionate as it has already been demonstrated that virilism (hirsutism, change in voice and slight enlargement of the clitoris) can be induced in some women who receive large doses of this substance.[16] Likewise some women gain weight and develop an acneform eruption. However, most of these disagreeable side-effects disappear slowly after the hormone treatment is stopped, but some may persist for six months or longer. These undesirable features of androgenic therapy may possibly be eliminated with the development of newer preparations which may retain the effectiveness of testosterone propionate but not the masculinizing activity of this substance.

SUMMARY

A follow-up of patients treated from seven to twelve months previously with testosterone propionate for gynecologic ailments with satisfactory results, revealed that more than 50 per cent continued to derive appreciable benefit after discontinuing the therapy. The patients with dysmenorrhea tended to relapse more often than those with excessive uterine bleeding but the smallness of our series of patients does not permit more definite conclusions. Twelve additional patients who were treated more recently, and of whom three had menorrhagia, one had menorrhagia and dysmenorrhea, three had menometrorrhagia, four had painful breasts, and one had premenstrual migraine, responded satisfactorily to androgen therapy except in one case of menometrorrhagia. The only disturbance observed occurred in a patient who received 350 mg. of testosterone propionate in one month and who developed considerable hirsutism and acne.

REFERENCES

(1) (a) *Robson, J. M.:* Quart. J. Exper. Physiol. **26:** 355, 1937; (b) *Korenchevsky, V., Dennison, M., and Eldridge, M.:* Biochem. J. **31:** 475, 1934. (2) *Leonard, S. L., Sager, U., and Hamilton, J. B.:* Proc. Soc. Exper. Biol. & Med. **37:** 362, 1937. (3) *Suprader, E.:* Ibid. **37:** 242, 1937. (4) *Browman, L. G.:* Ibid. **36:** 205, 1937. (5) *Freed, S. C., Greenhill, J. P., and Soskin, S.:* Ibid. **39:** 440, 1938. (6) *Zuckerman, S.:* Lancet **2:** 676, 1937. (7) *Hartman, C. G.:* Proc. Soc. Exper. Biol. & Med. **37:** 87, 1937. (8) *Papanicolaou, G. N., Ripley, H. S., and Shorr, E.:* Ibid. **37:** 689, 1938. (9) *Desmarest and Capitaine:* Presse méd. **45:** 779, 1937. (10) *Loeser, A. A.:* Lancet **1:** 373, 1938. (11) *Foss, G. L.:* Ibid. **1:** 992, 1938. (12) *Geist, S. H., Salmon, U. J., and Gaines, J. A.:* Endocrinology **23:** 784, 1938. (13) *Mazer, C., and Mazer, M.:* Ibid. **24:** 599, 1939. (14) *Greenhill, J. P., and Freed, S. C.:* West. J. Surg. **47:** 301, 1939. (15) *Engle, E. T., and Smith, P. E.:* Endocrinology **25:** 1, 1939. (16) *Greenhill, J. P., and Freed, S. C.:* J. A. M. A. **112:** 1573, 1939. (17) *Morgan, T. N., and Davidson, S. C.:* Lancet **1:** 861, 1937.

55 EAST WASHINGTON STREET

DISCUSSION

DR. PHILIP F. SCHNEIDER, EVANSTON, ILL.—Of the endocrine substances we have used the one that has been the most uniformly successful has been insulin in the treatment of diabetes. The satisfactory results obtained are due to the

purity of the substance and to the availability of blood sugar determinations as a guide for therapy. The estrin and progestin preparations that have been available for a number of years are pure ovarian substances, and we believe that vaginal smears and subjective symptoms may be utilized in the same manner as the blood sugar in the treatment of diabetes as guides.

We are told never to give estrin in large or in long-continued dosage to women prior to the menopause, because of the danger of producing ovarian atrophy. We know that if you give estrin to a woman who has normally functioning ovaries that atrophy will probably occur, but in the woman who has an estrin deficiency, ovarian atrophy already exists and adequate estrogenic therapy will not only not increase ovarian atrophy but will restore ovarian function to an approximation of the normal. This observation is based on vaginal smear control.

DR. KARL JOHN KARNAKY, HOUSTON, TEXAS.—At the menstrual disorder clinic of the Jefferson Davis Hospital in Houston we have used all the hormones and other drugs commonly advocated for dysmenorrhea and menometrorrhagia, but for some time obtained our best results with testosterone propionate. One of my young patients developed a coarse voice and one developed a visible mustache, both of which passed away within six weeks to six months.

By the use of stilbestrol, however, we have obtained most excellent results in our menorrhagia cases. The patient is given ten 5 mg. tablets and told to take one every night, beginning two or three days before the expected period. The period is then missed altogether, is delayed and shorter, or else the patient will spot for one to three days. The blood loss is decreased 95 per cent. The cost of such therapy is about seventy-two cents. There are no injections and the patient need not come to the office. The same amount of male sex hormone would cost thirty to thirty-five dollars, and our results are far better with stilbestrol than with male sex hormone.

Stilbestrol in 15 to 25 mg. doses will stop menorrhagia in a shorter time than that required to take the patient to the hospital, prepare the operating room, and do a dilatation and curettage. We now have a very potent drug, and if we so desire we can keep a woman from menstruating or bleeding as long as we deem necessary by giving 5 to 10 mg. of stilbestrol at night. No bleeding is produced when 5 mg. (125,000 I.U.) are given each day, but if the drug is stopped there follows in one to four days a spotting which lasts for one to eight days.

Leiomyomas of the uterus and polyps of the endometrium are also controlled by stilbestrol. One now can give 15 to 25 mg. and control the flooding from these sources, thereby saving an emergency operation as well as the loss of vital blood. When 25 mg. of stilbestrol are given, the follicles become hemorrhagic which may lead to moderate pains in the ovarian regions. In twelve cases of incomplete abortion bleeding stopped by the treatment employed in other uterine bleeding cases. Six cases of increased bleeding at delivery were checked by giving stilbestrol as outlined.

DR. M. EDWARD DAVIS, CHICAGO, ILL.—We have had considerable experience with the use of testosterone propionate in very moderate doses, and in general we can confirm all the findings of Dr. Greenhill.

During the past year we have administered stilbestrol orally to some 200 patients in need of estrogenic medication. There is no need to use the tremendous doses suggested by one of the discussants. Usually, one milligram administered daily, orally, is sufficient entirely to replace ovarian activity. There has been considerable discussion concerning the toxicity of this substance. We have under way a number of experiments on the long-continued administration of moderate amounts of stilbestrol in an attempt to determine the possibility of late undesirable effects. Thus far, the moderate amounts used clinically have produced no evidence of toxicity.

DR. GREENHILL (closing).—I believe that Dr. Karnaky is much too enthusiastic about stilbestrol. Furthermore, this drug may produce disturbances in some

organs even though these alterations may not be demonstrable under the microscope. We do know that many women have nausea and vomiting following the use of stilbestrol and in some animals, liver damage has been demonstrated after administration of large doses of this substance.

Notwithstanding the fact that many of us have obtained good results in some gynecologic disorders, we should not recommend the indiscriminate use of the male hormone or stilbestrol by general practitioners.

POST-PARTUM LABIAL OR PARAVAGINAL HEMATOMAS*

HUGH G. HAMILTON, KANSAS CITY, MO.

LABIAL or paravaginal hematomas are unusual complications of the puerperium, but when they do occur, they can present a very serious situation unless diagnosed early and actively handled. The first report of such a case is by Rueff in 1554. The literature on the topic is not voluminous, and there are relatively few cases to be found reported.

These hematomas may be divided into two groups, the immediate and the delayed. The immediate type occurs as soon as the labor is finished and is usually considered traumatic, though this is not actually correct.

In this connection Frank-Kamenetsky[1] reports four cases of twin delivery in which the hematoma manifested itself during the time between the delivery of the first and second baby. The delayed type is usually due to necrosis of the blood vessels and may occur as late as twenty-one days post partum. DeLee[2] reports one case occurring this late. Manzi[3] reports a case of chorionepithelioma which very closely resembled the delayed paravaginal hematoma.

The symptomatology in either type of case and the prognosis and treatment are essentially the same. Since the hemorrhage occurs in a soft, bruised tissue, there is widespread dissection, and the most striking symptom is excruciating pain, which is not relieved by reasonable doses of opiates and becomes progressively more severe. If the hemorrhage occurs external to the pelvic fascia and the levator ani muscles, the dissection is downward, and there is, first, unilateral labial and vulvar edema followed by the appearance of a bluish, discolored mass which is painful, elastic, tense, fluctuating, and extremely sensitive to palpation. This mass may extend back into the ischiorectal fossa and over into the buttock and, if allowed to increase in size, may displace the anus, perineum, and vagina over to the opposite side.

If the hemorrhage occurs above the level of the pelvic fascia and the levator ani muscles, the patient will have the same severe pain, and coupled with this will present usually the unilateral edema due to circulatory interference by compression. Rectal and/or vaginal exami-

*Read at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

nation will reveal an extremely tender, rounded, fluctuating, tense mass, extending into the vaginal and/or rectal space. It will dissect upward beneath Poupart's ligament, into the broad ligament and parametrial tissue and even upwards retroperitoneally to the diaphragm. When the hemorrhage becomes massive, the patient will already have shown the signs of progressive acute anemia and will now manifest the symptoms of shock due, not only to the active blood loss, but also to the tissue trauma of the dissection.

The usual concept of the etiology is that trauma is the major factor, and DeLee,[2] Vaux,[4] Williams,[5] Dorland,[6] and others hold that the immediate type is traumatic in origin. Frank-Kamenetsky[1] reports that 52.5 per cent of his 82 cases were of traumatic origin. Likewise there is general agreement that most delayed cases are due to pressure necrosis from prolonged compression of the vessels by the fetal head. However, these concepts do not take into consideration other factors, such as inelasticity of blood vessels (Buford Hamilton) which undergo laceration under tension without laceration of other tissues, or increased fragility of the blood vessels and hemorrhagic tendencies associated with constitutional conditions. Vaux[4] and Bland[7] mention the vascularity of the pelvic tissues at the time of delivery, with the occurrence of varicosities of the pudendal veins as an etiologic factor, but DeLee[2] denies the view that varicosities have anything to do with it. In our series there were no varicose veins noted in any of the cases.

Williams[8] describes in his work on abruptio placentae, changes in blood vessels, associated with albuminuria, which are sometimes so pronounced that the patients have an hemorrhagic tendency even in the absence of hypertension. Likewise, there are those cases of albuminuria in pregnancy wherein are seen retinal hemorrhages and epistaxis as in Solomons'[9] case. In this connection it is interesting to note the case reports of the following men: Shaw[10] reports a 39-year-old primipara with albuminuria who developed an immediate hematoma in a nontraumatic delivery which was not drained, with a fatal result; Gibberd[11] reports a case of a primipara with albuminuria who developed epistaxis and a hematoma ante partum which required drainage to permit delivery; and Danby,[12] Liepman,[13] Hirsch,[14] and Krause[15] also report cases of hematoma associated with albuminuria with or without hypertension.

There can be little doubt that trauma and pressure necrosis alone are not the only factors in the production of hematomas, as in too many cases the birth is spontaneous, not unduly prolonged and delivery is accomplished without any apparent trauma. Furthermore, if one can establish the presence of vascular changes in certain conditions in pregnancy which produce hemorrhagic tendencies in other tissues of the body, it is perfectly reasonable to assume that these vascular changes would produce hemorrhage in the pelvic tissues where the most bruising and stretching occurs.

Prior to the time of active treatment of these hematomas there was according to DeLee[2] and others a mortality rate as high as 40 per cent. However, for the last thirty years the mode of treatment recommended has been more or less active, and, during that time, the mortality statistics have been essentially the same, except in Williams'[5] report on 33 cases where the hematomas were retroperitoneal in type, in which series there was a mortality rate of 56 per cent. In Frank-Kamenetsky's[1] report there is a gross mortality of 9.5 per cent, a series of 82 cases. Vaux[4] reports a 12 per cent mortality, and in this series of cases there was a mortality rate of 8.3 per cent.

There is a wide variation in the incidence of this condition. DeLee[2] reports 1 case to 7,500, Williams[5] 1 case to 2,000 deliveries, and Dorland[6] 1 case to 1,600 deliveries. In our series it was impossible to estimate accurately the incidence of occurrence, as it includes the private practices of several men and several patients were referred to these obstetricians by other doctors.

Every obstetrician from time to time has prevented the occurrence of these hematomas, when commencing to do a perineorrhaphy, by noticing a small hematoma in one or the other side which he opened and sutured. However, it is only in these cases where suturing is practicable, for if the hematoma has been allowed to dissect at all, the original bleeding point is lost in the maze of small, bleeding, oozing vessels where the dissecting blood mass has torn along the fascial planes, damaging the venous system. Each of the authors on this subject recommends expectant treatment with compression and ice therapy in small hematomas which are not increasing in size; and incision, evacuation of clots and packing of those which are large or in which the dissection is continuing. From the results in our series and from the study of other case reports, it would seem feasible to recommend the earliest possible diagnosis and then incision, evacuation of clots, and packing in all cases. Of course, if there is shock, infection, or anemia, blood transfusions and other supportive measures should be instituted.

Coulin[16] reports a case where the hemorrhage dissected up into the parametrium and retroperitoneally. The patient eventually recovered upon incision, evacuation of clots, and packing. In Danby's[12] report one case was not drained for two days, and although she recovered she had a prolonged, febrile convalescence. In this series the only fatality was in the one case in which the so-called "expectant" treatment was used, and the patient died a septic death.

In the consideration of Williams'[5] series of 33 cases of which 56 per cent were fatal, the hematomas were either late in being diagnosed or the patients would not have had such massive extension of the process unless they were victims of the expectant method of treatment. The mode of death in these cases was concealed hemorrhage, or rupture of the hematomas into the peritoneal cavity or subsequent infection.

The most practical method at which one can arrive for the management of this condition then is: first, the earliest possible diagnosis; second, incision, preferably through the vaginal mucosa, into the hemorrhagic cavity; third, evacuation of the clots; fourth, loose packing of the cavity with tight packing of the vagina, and a tightly applied T-binder for compression, with removal of the packing in twelve to twenty-four hours; fifth, transfusion or other such supportive or medical measures as may be indicated.

Including our series and those of Frank-Kamenetsky,[1] DeLee,[2] Williams,[5] Gibbert,[11] Danby,[12] Shaw,[10] Coulin,[16] Liepman,[13] Hirsch,[14] Pio,[17] Polasek,[18] Benedetti,[19] D. VanVugt,[20] Argonz,[21] Moshkow,[22] Morosoff,[23] Narvaez,[24] and Horvath,[25] there is a total of 156 reported cases of post-partum paravaginal hematomas. Complete data are not available on all the cases, but the figures shown in Tables I to IV are based on 127 cases in which the data are sufficiently complete for statistical purposes.

TABLE I. PARITY

	NUMBER OF CASES	PRIMIPARAS		MULTIPARAS	
		NUMBER	PER CENT	NUMBER	PER CENT
Our series	12	10	83	2	17
Total series	127	74	59	53	41

TABLE II. TYPE OF DELIVERY

	NUMBER OF CASES	SPONTANEOUS		OPERATIVE	
		NUMBER	PER CENT	NUMBER	PER CENT
Our series	12	9	75	3	25
Total series	127	73	58	54	42

TABLE III. TYPE OF HEMATOMA

	NUMBER OF CASES	IMMEDIATE		DELAYED	
		NUMBER	PER CENT	NUMBER	PER CENT
Our series	12	11	91	1	9
Total series	127	110	87	17	13

TABLE IV. MORTALITY RATE

	NUMBER OF CASES	NUMBER OF DEATHS	PER CENT
Our series	12	1	9
Total series	127	27	21

It would appear that if this complication is early recognized and actively treated the mortality rate can be materially improved. Another interesting observation is that in our series of cases handled in this manner, on subsequent examination there was practically no residual distortion of tissue, and three of this series have subsequently delivered with no pathology referable to their previous complication.

CASE REPORTS

CASE 1.—Patient, primipara, aged 25 years, three-weeks premature, no albuminuria, no hypertension, had a spontaneous delivery and an episiotomy with immediate repair. Eight hours after delivery edema of the labia was observed and the patient was suffering from severe perineal pain. The hematoma was incised, the clots were removed, and the cavity was packed. There was an uneventful convalescence.

CASE 2.—Patient, primipara, aged 28 years, had a three-weeks premature delivery due to induction of labor for albuminuria and hypertension. There was a spontaneous delivery of a small fetus with episiotomy and immediate repair. Within two hours the patient was having severe pain, edema of the left labia, and there was a typical hematoma mass. It was incised, the clots were removed, and it was left unpacked. There was some drainage for eight days, but the patient left the hospital in good condition.

CASE 3.—Patient, a primipara, aged 27 years, had a spontaneous delivery with episiotomy and repair. Two hours after delivery the patient had severe pain which became progressively worse, and she developed edema of the left labia. Vaginal examination revealed a tense, painful, fluctuating mass filling the vagina from the left and arising high in the vagina. It was incised, the clots were evacuated, and the cavity was packed. The patient made an uneventful recovery.

CASE 4.—Patient, multipara, aged 23 years, had a low forceps delivery, with episiotomy and repair at her first delivery. The present delivery was spontaneous with episiotomy and repair. Four hours after delivery she had extreme pain which was completely unrelieved by opiates. There was a bluish, fluctuating tense mass in the region of the left labia about the size of a grapefruit, and the vaginal cavity was filled. Within another hour she was in shock, for which she received 2 blood transfusions of 500 c.c. each. When she recovered from her shock the hematoma was incised. About 2,500 c.c. of clots were evacuated and the cavity was packed. She was given another 500 c.c. blood transfusion about four hours later and had an uneventful convalescence. She has since delivered spontaneously with no difficulty.

CASE 5.—Patient, primipara, aged 19 years, had a posterior position which rotated and delivered spontaneously without laceration. Eight hours later she had severe pain and left labial edema with some discoloration. Ice packing and tight compresses were applied. Obstetric consultation was requested and the consulting obstetrician flatly refused to allow interference and continued the expectant treatment. The following day the patient had two severe chills with the temperature as high as 105° F. She continued to have chills several times a day, and two days later surgical consultation was obtained. The surgeon felt the infected hematoma mass would drain spontaneously and suggested further expectant treatment. On the sixth day a small draining sinus developed from which came a little serosanguineous material, but the main mass did not drain. Her sepsis continued and became progressively worse and she died on the twelfth day. Permission for an autopsy was not obtained.

CASE 6.—The patient was a multipara, aged 35 years. Breech extraction of a frank breech was performed with episiotomy and repair. She began complaining of pain on the eighth day and developed right labial edema on the ninth day. On the tenth day the tense, fluctuating vaginal mass was incised and about a pint of clots were removed, but she was not packed. The pain recurred and again on the thirteenth day the cavity was reinvaded, the clots evacuated, and the packing inserted and left in place for twenty-four hours. She ran a low grade temperature until the nineteenth day and left the hospital, well, on the twenty-second day.

CASE 7.—The patient, a primipara, aged 25 years, delivered spontaneously with episiotomy and repair. Three hours after delivery she developed severe perineal pain, the unilateral edema appeared in five hours, and seven hours after delivery the hematoma was incised, the clots evacuated and the cavity and vagina packed. The packing was removed in eighteen hours and she had an uneventful convalescence.

CASE 8.—The patient, a primipara, aged 30 years, was delivered by difficult midforceps and episiotomy with immediate repair. Within an hour she began to have severe pain and unilateral edema. In ten hours there was a large, swollen, tender fluctuating mass beneath the left labia majora with a bluish discoloration. This was incised, about a quart of clots were evacuated, and the cavity and vagina packed. Because of her anemia she was given 2 transfusions in the succeeding forty-eight hours, and although she ran a low grade temperature, she was well upon leaving the hospital on the nineteenth day.

CASE 9.—The patient, a primipara, aged 28 years, delivered spontaneously with second degree laceration and repair. Within nine hours she had developed a typical hematoma of left sublabial region which was incised; about 1,500 c.c. of clots were evacuated, and the cavity and vagina were packed. She was given 500 c.c. of blood. She ran a low grade temperature for eight days but following another 500 c.c. transfusion the temperature returned to normal and she left the hospital in good condition.

CASE 10.—The patient, a primipara, aged 23 years, delivered spontaneously without laceration. Within two hours a large hematoma had developed in the right labia majora, which upon incision yielded 1,250 c.c. of measured clots. The cavity and vagina were packed, and she was given 750 c.c. of blood. She had an uneventful convalescence.

CASE 11.—The patient, a primipara, aged 37 years, delivered spontaneously with episiotomy and repair. Three hours later she developed severe pain in the left labia along with unilateral labial edema. Vaginal examination revealed a rounded, tense, fluctuating, painful mass, arising high in the vault of the vagina. This was incised, about 400 c.c. of clots were evacuated, and the cavity and vagina were packed, with the packing being removed in twelve hours. She had an uneventful convalescence.

CASE 12.—The patient was a primipara, aged 19 years. Labor was induced at thirty-seven weeks' gestation for albuminuria and generalized edema without hypertension. About four hours prior to delivery she had severe epistaxis. Delivery was spontaneous without laceration. About four hours after delivery she complained of severe pain in the left side of the perineum, and a very marked edema of the left labia was found. Vaginal examination revealed a mass the size of an orange protruding in the vaginal cavity from the left. This was incised, about 600 c.c. of clots were evacuated, and the cavity and vagina were packed. The packing was removed in fourteen hours and, aside from another attack of epistaxis the following day, she had an uneventful convalescence.

I wish to express my deep appreciation to Drs. J. G. Webster, Paul V. O'Rourke, Buford G. Hamilton, Ralph R. Wilson, and E. C. White for allowing me to draw upon their private records in compiling the cases included in this report.

REFERENCES

(1) *Frank-Kamenetsky:* J. Obst. & Gynaec. Brit. Emp. **17:** 121, 1910 (Review). (2) *DeLee, J. B.:* Principles and Practice of Obstetrics, Philadelphia, 1927, p. 783. (3) *Manzi, L.:* Arch. di ostet. e ginec. **2:** 349, 1938. (4) *Vaux, N. W.:* Edgars Practice of Obstetrics, ed. 6, Philadelphia, 1926, p. 487. (5) *Williams, Whitridge:* Obstetrics, New York, 1930, p. 1106. (6) *Dorland, W. A. U.:* Manual of Obstetrics, Philadelphia, 1896, p. 597. (7) *Bland, P. Brooke:* Practical Obstetrics, Philadelphia, 1932, p. 501. (8) *Williams, Whitridge:* Surg. Gynec. Obst. **21:** 541, 1915. (9) *Solomons, Bethel, and Wilson, T. G.:* Irish J. M. Sc., p. 154, 1927. (10) *Shaw, Wm. Fletcher:* J. Obst. & Gynaec. Brit. Emp. **31:** 651, 1924. (11) *Gibberd, S. F.:* Guy's Hosp. Report **78:** 249, 1928. (12) *Danby, A. B.:* Proc. Royal Soc. Med. **17:** 20, 1924. (13) *Liepman:* Berlin med. Gesellch. **11:** 1909. (14) *Hirsch:* Monatschr. f. Geburtsh. u. Gynäk. **31:** 1910. (15) *Krause, H.:* Zentralbl. f. Gynäk. **49:** 2465, 1925. (16) *Coulin, R. F.:* Semana méd. **2:** 1676, 1929. (17) *Pio, G.:* Riv. d'ostet. et ginec. prat. **20:** 329, 1939. (18) *Polasek, F.:* Ceskoslov. gynaek. **16:** 368, 1937. (19) *Benedetti, I.:* Atti Soc. ital. di ostet. e ginec. **34:** 224, 1938. (20) *van Vugt, D.:* Nederl. tijdschr. v. geneesk. **77:** 3557, 1933. (21) *Argonz, E.:* Rev. méd. del Rosario **23:** 565, 1933. (22) *Moshkow, B. N.:* Monatschr. f. Geburtsh. u. Gynäk. **92:** 421, 1932. (23) *Morosoff, K. F.:* Vrach. gaz. **34:** 1145, 1930. (24) *Narvaez, F.:* Rev. méd. de Yucatán **16:** 2, 1930. (25) *Horvath, Z.:* Budapesti orvosi ujság **36:** 577, 1938.

1107 BRYANT BUILDING

DISCUSSION

DR. CLARENCE B. INGRAHAM, DENVER, COLO.—We have had but one case of vulval hematoma at the Colorado General Hospital. A twenty-seven-year-old woman, who had had one previous pregnancy, delivered elsewhere by cesarean section at seven and one-half months because of a kidney complication, was admitted to our institution in the last month of her second pregnancy with a blood pressure of 150/100 and a right-sided hydronephrosis. Labor occurred at term. There was a spontaneous premature rupture of the membranes; the first stage lasted twelve hours and was without medication. When the head was well engaged and the cervix fully dilated, a hematoma of the left labium majus began to form, reaching within an hour a diameter of about three and one-half inches and encroaching upon the vagina sufficiently to interfere with progress. Forceps were applied, with an easy delivery of a 3,200 Gm. child in right occiput anterior. During this procedure the hematoma ruptured at the junction of the labium and vagina with the escape of clots and a large amount of bleeding which was controlled by pressure. Her convalescence was uneventful except for four days of moderate temperature, less than 101° F.

Another case with subperitoneal hemorrhage occurred last spring at the Greeley Hospital, a town about fifty miles from Denver, and was attended by Dr. N. A. Madler who consulted me about five hours after the occurrence of the initial signs. I did not see the patient but will report the case, because it is typical of an extensive retroperitoneal hematoma.

A woman, aged 21 years, para ii, was delivered normally with no medication and an easy labor. About two and one-half hours afterwards, she complained of abdominal pain and was later in shock. A mass was seen in the vagina, and there was a rising upwards of the fundus almost to the xiphoid. There was very little external bleeding. She was given morphine and intravenous glucose. Twelve hours later she was in profound shock, clammy, the temperature subnormal, and the pulse 160. An extravasation of blood around the anus and perineum with discoloration into either buttock was present. The cervix could not be felt, due to the large mass filling the vagina pressing forward from behind.

After transfusion an incision was made through the posterior vaginal wall with the evacuation of large clots. This was followed by active bleeding which could not be controlled with packs, and necessitated a laparotomy.

On opening the abdomen the uterus was found lifted up by a large subperitoneal hemorrhage; there was bloodstained fluid but no intraperitoneal bleeding. A hysterectomy was done. Extravasation had occurred into both broad ligaments, separating the leaves, and extended upwards along the sigmoid and downward along the rectum. The starting point of the bleeding could not be determined. With the exception of a severe reaction following one of several transfusions, this patient made a good recovery.

DR. J. R. MANLEY, DULUTH, MINN.—I would like to report two cases with this condition. (1) The first was a primipara who delivered spontaneously with a small first degree laceration. Some time later she went into shock, experienced considerable pain and something was coming out of the vulva which had the appearance of a placenta. It was a hematoma of the vaginal wall, about the size of a grapefruit, and had the appearance of the fetal side of the placenta. The patient was taken to the operating room and the hematoma opened. The hematoma did not extend up under the peritoneum, and there was very little difficulty in stopping the bleeding.

(2) The second case was not recognized for about a week. She had had a spontaneous delivery, followed by thrombotic hemorrhoids and a constant complaint of pain around the perineum. I finally decided to remove the hemorrhoids before she left the hospital, and only then discovered a large hematoma of the vulva.

DR. WILLIAM H. RUBOVITS, CHICAGO, ILL.—My case, a woman, seen in Michael Reese Hospital, began to bleed from the upper end of the episiotomy incision about the eighth day following delivery. In the course of the next eight weeks she was packed at least every other day. The wound was resutured ten times. She was given 10 transfusions. The internal iliac arteries were ligated, and the woman recovered. A detailed study of the blood by a competent hematologist revealed no dyscrasia of any kind. Nevertheless about two and one-half months after leaving the hospital, this patient began to bleed from the base of the tongue following a violent kiss, and died from this hemorrhage.

DR. HAMILTON (closing).—We were unable to demonstrate the direct arterial bleeding in any of our series.

I was interested to hear Dr. Rubovits' remarks because I felt that many of these cases were based on a hemorrhagic tendency. I think the cause in the beginning is a very small artery, but the additional bleeding is probably venous in origin, at least it would appear so from the inspection of the cavity. The difficulty, as has been mentioned, is in trying to find the offending vessel.

POST-PARTUM STERILIZATION*

H. P. Hewitt, B.S., M.D., F.A.C.S., and J. R. Whitley, M.D.,
Chattanooga, Tenn.

(From the Department of Obstetrics of the Baroness Erlanger Hospital)

DURING the last fourteen months at the Baroness Erlanger Hospital, we have sterilized one hundred women on the charity service by tubal ligation, within an hour after delivery. Other than reports made by Dr. Skajaa of Switzerland and in March of this year by Drs. Adair and Brown of Chicago, we have no statistics for comparison with our results.

As there are 26 methods by which the female may be sterilized, this seems to prove that no one method is ideal. For example, the senior author (H. P. H.) has seen one patient who had never been pregnant prior to an operation, at which both tubes and the right ovary were removed and the left ovary which was cystic was resected, and then sutured to the fundus of the uterus. Eight months after the operation, this patient became pregnant and has delivered three full-term infants since then.

Many of the articles written on sterilization deal with women past the childbearing age. Our group is composed entirely of mothers in the childbearing age, and sterilization was performed following only spontaneous deliveries.

LEGAL CONSIDERATION

Since there is no special law dealing with sterilization in Tennessee, we follow the procedure of having two physicians state that it is to the best interest of the mother's health that she should be sterilized. A slip is signed by the patient and her husband giving permission for sterilization, and at the time of the operation we have the chief of the prenatal clinic with the attending man on the indoor service to sign the prenatal record, recommending post-partum sterilization.

Table I. Indications

Of the 100 charity patients, 90 were white and 10 colored.	
Hypertension	1
Recurrent pyelitis	1
Toxemia of pregnancy	1
Nephritic toxemias and hypertension	1
Syphilis	10
Social and economic	30
Pulmonary tuberculosis	4
Rheumatic heart disease	2
Multiple pregnancies	50

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

Among these 100 cases, there was one set of twins, 1 breech delivery, and 4 patients were induced medically at term. All deliveries were spontaneous.

The average age of the patients was 31 years, the youngest being 20 and the oldest 45 years of age. Average parity was 5½. The average period of post-operative hospitalization was 9.4 days, the average length of labor being 8.75 hours. The longest labor was twenty-four hours and the shortest, one and one-half hours. The average time from rupturing of the membranes to delivery was two hours.

MORBIDITY AND MORTALITY

There was no mortality in the 100 charity patients, and the morbidity was 2 per cent, or 2 cases, using the standard of morbidity as approved by the American Committee on Maternal Welfare. One patient developed pyelocystitis and ran a fever from 99° to 103° F. for five days. On the sixth day the temperature was normal. She was treated with sulfanilamide and given two blood transfusions. Otherwise she made an uneventful recovery. The other developed puerperal sepsis, temperature beginning on the third day and ranging from 100° to 104° F. for one week. She was treated with sulfanilamide and blood transfusions. Otherwise she made an uneventful recovery. One patient had a temperature of 101° F. on the fourth post-partum day only and ran an afebrile course during the puerperium. One patient had a chill on the first post-partum day and a temperature of 102° F., and then ran an afebrile course during the puerperium. We had four minor wound infections in the patients who had syphilis. The drainage was mostly serum and not pus, but all wounds healed before the patients left the hospital.

TECHNIQUE OF OPERATION

All of the patients were selected from those who had had spontaneous deliveries and no contraindications to operation. Immediately following delivery the patient was given ¼ gr. of morphine and $\frac{1}{150}$ gr. of atropine. The abdomen was prepared for operation and the patient sent to the operating room one hour after delivery. In about one-half of the cases we used cyclopropane-gas-anesthesia and in the other one-half we used ether. An incision 1½ inches long was made immediately below the umbilicus, and the uterus was pushed to one side, bringing the tube into the incision. The tubes were picked up about the middle third and a large loop was crushed in three places. Each crushed place was tied with a linen suture inserted through the mesosalpinx. This is somewhat different from the Madlener technique: where a small loop is used and crushed in three places but tied in two. The postoperative orders are the same as our routine post-partum orders, that is giving a regular diet and enema on the third day, and rarely, if ever, do the patients require any opiates other than codeine and aspirin for afterpains.

FOLLOW-UP

To date, we have not had any pregnancies occur after our triple ligation method. All of the patients have been highly pleased to date with the results of the operation.

We had three patients who complained of mild dysmenorrhea following the operation, who had never had any discomfort during menstruation before. There were four patients who menstruated every two weeks after the menses returned following operation, who did not receive any treatment and adjusted themselves to a twenty-eight- to thirty-day cycle.

DISCUSSION

This report of 100 patients sterilized one hour after delivery was done to determine the safety and advisability of post-partum sterilization. Our results compare very favorably with those reported by

Adair and Brown. They reported a series of 50 cases with a morbidity of 12 per cent, and our morbidity was 2 per cent. In neither series was there any mortality. The average stay in the hospital of our patients was 9.4 days, and theirs was 11.3 days. Our average parity was 5.5 and theirs was 4.6. We did one-half of our operations with ether and one-half with cyclopropane-gas. The patient who developed pyelocystitis received gas, and the patient who developed puerperal sepsis was given ether. Adair and Brown used local anesthesia. Dr. Skajaa stated that using ether for anesthesia increases chances for thrombosis and embolism, which did not occur in our series. Labor was induced medically in 4 per cent of our patients, compared to Adair and Brown's 10 per cent. We must admit that we were very lenient in our indications for sterilization. In a majority of the cases under the headings, "social and economic and multiple pregnancies," we were influenced by their mentality in being able to control future pregnancies. In patients who we considered had intelligence to use the accepted method of contraceptive procedure, we did not urge sterilization. We were very cautious in selecting the patients who did not have any difficulty at delivery and no chances of infection. Thereby, we refused all patients for post-partum sterilization who had had an operative delivery of any kind. In most of our patients the operation was done by the resident surgeon of the hospital, and we insisted that in ligating the tubes the operator must follow the tube out to the fimbriated end to be sure that he was ligating the Fallopian tube and not the round ligament. We feel that the triple ligation gives an added percentage of safety over double ligation. We have not included any cases of tubal ligation where the patient had indication for cesarean section. We know definitely that we have not done as many cesarean sections since we have been doing post-partum sterilization as we did formerly with sterilization as an indication. We feel that any individual who has had all the children she desires, and is past thirty-five years of age should be sterilized according to her wishes. Previous reports on tubal ligation show that there is a 5 per cent failure over a period of ten years, so the nearer the menopause the patient is the smaller will be the percentage of failures.

Since the above report is so favorable, we would like to sound a note of warning by giving the results obtained in 25 private cases which have been done at the Erlanger Hospital in the past eighteen months. In this group there was one failure after ten months, and there was one death twelve days post partum due to embolus. This patient weighed 300 pounds, had a blood pressure of 240/130, and delivered a macerated fetus at term. She had a chronic nephritis and was given an ether anesthetic. She had a low grade infection following delivery and operation which lasted a week. Her temperature never went above 102° F. On the twelfth day when she started to get out of bed she died suddenly due to embolus. The patient having hypertension, chronic nephritis, and delivering a macerated fetus, probably should not have been sterilized. At a later date I hope to

report further on post-partum sterilization and compare the results with charity and private patients.

CONCLUSIONS

1. One hundred cases of tubal ligation done one hour after delivery on patients who delivered spontaneously are reported.
2. There was no mortality in the 100 cases reported. We had a 2 per cent morbidity.
3. Our percentage of cesarean sections have materially decreased since doing post-partum sterilization.
4. To date we have not had any failures reported.
5. Post-partum sterilization offers an economical means of sterilization from the standpoint of hospitalization, as it does not prolong the stay in the hospital and does not give the patient any discomfort as does the average pelvic operation.
6. The time consumed in the operation is short, averaging fifteen minutes.
7. We feel that one hour after delivery is the best time for it to be done, because the fundus is even with the umbilicus and we have less difficulty in exposing the tubes than we would if we waited a few days longer.
8. If the uterus is not manipulated too much, the bleeding during the operation will be small.
9. Involution of the uterus was not retarded.
10. We feel that post-partum sterilization is safe in selected cases.

REFERENCE

Adair and Brown: AM. J. OBST. & GYNEC. **37**: 472, 1939.

DISCUSSION

DR. CECIL W. SEIBERT, WATERLOO, IOWA.—Any one who practices obstetrics will have from time to time patients who have definite indications for sterilization. It is extremely difficult to get these patients back in the hospital at a later time for the operation. This is not only a financial burden which is in many cases prohibitive, but most mothers are loath to leave their young baby in the care of strangers until after it is a year old, and by that time another pregnancy may be present. The procedure that has just been recommended escapes these disadvantages and will appeal to most patients as being both logical and practical.

I believe that the small incision should be emphasized. This should not be an exploratory operation, and with a small incision, there is no temptation to remove the appendix or resect cystic ovaries, etc. The Madlener technique which is now quite generally used lends itself well to the small incision. Tubal or cornual resection is at times somewhat bloody, and many cases of pregnancies following sterilization by this technique have been reported.

In the past year I have had occasion to do five post-partum sterilizations in private practice. These have all been done on the third post-partum day; the thought being that any serious degree of puerperal sepsis should manifest itself by that time, in which event the operation would not be done. There was no morbidity and all were discharged on the tenth post-partum day.

DR. FRED L. ADAIR, CHICAGO, ILL.—This operation is one that can be done very simply, exposing first one tube and then the other, clamping and ligating each, and it can be done under local anesthesia. I believe it is a safe operation

if the conditions are carefully evaluated. It is very important to eliminate cases that have been manipulated or that are what we might call potentially infected.

One point of view we have is somewhat different from that taken by Dr. Seibert. He feels that he should wait until the possibility of puerperal infection is excluded. On the other hand, we take the point of view that the genital tract becomes more or less infected or contaminated by bacterial growth, the longer you wait following delivery. We have placed a twenty-four-hour limit on puerperal sterilization and would be rather inclined to follow an even more limited period of time than to extend it beyond the twenty-four-hour limit. I believe this is very important in connection with the management of these cases, because the lochial discharge does change following delivery. Any case that is mechanically induced, as distinguished from medical induction, should be excluded from the series, as well as any case of operative delivery by version or extraction, as pathogenic microorganisms may be present and might become active in the vicinity of the tube. This type of case is not really suitable for vaginal sterilization, so I presume that Dr. Hewitt would not advise that within the twenty-four-hour limit after delivery.

DR. P. B. RUSSELL, JR., MEMPHIS, TENN.—We agree with Dr. Adair that within twenty-four hours this is a simple procedure without much risk. Some of our staff have used the Madlener technique, others have used the method suggested at one time by the late Dr. Williams, but the success of the ligation depends upon the operator. Fistulas will result if the tube is crushed too gingerly, or the sutures cut through.

DR. HEWITT (closing).—About the time of operation, we do it within one hour because that is the safest time up to twenty-four hours. We have had some which were done as late as sixteen hours. Our results show that it is safe to do post-partum sterilization by tubal ligation.

THE INDUCTION OF LABOR WITH SMALL DOSES OF POWDERED ERGOT*

A PRELIMINARY REPORT

CLAUDE J. EHRENBERG, M.D., OWEN F. ROBBINS, M.D., AND JOHN A. HAUGEN, M.D., MINNEAPOLIS, MINN.

THE observations from which this preliminary report is made began in 1935, following a dramatic maternal and fetal death ten hours after the first ingestion of three 5-gr. doses of quinine sulphate. Although the cause of death was not proved by an autopsy, the circumstances were such as to permit of no other conclusion than fatal quinine poisoning.

A growing literature reveals the dangers of quinine for the prospective mother and the fetus, the appreciation of which is indicated by the general recession from the use of quinine for the purpose of labor induction.[1-4] Contrary to obstetric opinion, we have found that small doses of ergot can be tolerated by the pregnant woman without ill effect. This special ergot is in dried powdered form and has been standardized according to the *United States Pharmacopoeia*, No. XI,[5]

*Presented at a meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, November 2 to 4, 1939.

after extraction to exhaustion as recommended by Thompson.[6] Beginning with smaller amounts, it was determined that a dose equivalent to 12 gr. (0.8 Gm.) U.S.P. ergota preparata, administered by mouth at intervals of from two to three hours, was effective for inducing labor.

Castor oil, from one to two ounces, was given one-half hour before the first dose of ergot. Usually two, but occasionally three doses of ergot have been given and labor has been considered induced if uterine contractions commenced within twenty-four hours after the administration of the first dose. If, as has happened on a few occasions, pains began after the ingestion of the first dose of ergot, no more was given.

U.S.P. ergota preparata is defatted and is standardized to possess the equivalent of 0.5 mg. of ergotoxin ethanesulphonate each gram. If kept dry, the product is stable indefinitely. According to Thompson,[7] all of the alkaloids in ergot except ergonovine may for practical purposes be calculated as ergotoxin. The U.S.P. assay then, while adequate for all of the other component alkaloids of ergot, is inadequate for the determination of the ergonovine equivalent content. Theoretical objection to whole ergot for oxytocic usage is possible on the grounds that a high ergotoxin equivalent assay may be accompanied by a low ergonovine content or vice versa. However, a number of workers[8, 9] have shown that the total alkaloid to ergonovine relationship in various samples of whole ergot is from 4 to 5 to 1. Whole ergot, therefore, may reasonably be expected to contain as ergonovine 20 to 25 per cent of the whole alkaloid content. The 12 gr. equivalent of the ergot used during these observations was actually *165 mg.* which, on a basis of the above computation, would contain from 0.07 ($\frac{1}{900}$ gr.) to 0.1 ($\frac{1}{640}$ gr.) mg. of ergonovine equivalent strength.

The results of our observations in tabulated form are given in Tables I and II.

TABLE I. ATTEMPTED ERGOT INDUCTIONS

Group 1.	Ergot and castor oil	142
Group 2.	Ergot and castor oil plus posterior pituitary extracts	25
Group 3.	Ergot and artificial rupture of membranes, either before or after	26
Group 4.	Ergot and insertion of bougies	2
	Total	195

Fetal Mortalities.—CASE 1.—Induced thirty days before term and two weeks after clinical and x-ray diagnosis of intrauterine death of the fetus.

CASE 2.—Difficult version and extraction, 9½ pounds, eighteen days postmature baby, and thirty-six hours after induction with castor oil and ergot, 2 doses, with four-hour rest period intervening. Autopsy demonstrated intracranial hemorrhage. Primiparous mother.

CASE 3.—Outlet forceps, seventeen and one-half hours after induction with castor oil and ergot, 2 doses, and normally progressing labor. Infant made respiratory attempts but could not be resuscitated. No autopsy. Para ii mother.

Fetal Morbidity.—In the 184 pregnancies reported, all of which were from private practice, the babies have been observed during their hospital residence and in most cases afterwards by competent pediatrists. In the 181 living babies there has been no serious or unusual morbidity in the hospital, or as far as can be ascertained, during the afterlife.

Maternal Morbidity.—The maternal morbidity has been considered from the immediate and remote standpoint. Labor following the ergot method of induction generally has not been more rapid than that in spontaneous labor. In Group I of the tabulated results, there were 58 primiparas and 53 multiparas. The shortest labor in

TABLE II. RESULTS

Ergot and castor oil			Group 1.	
Successful (39 days before to 24 days after term)		111	78.2%	
Failures (24 days before to 18 days after term)		31	21.8%	
Ergot and castor oil and posterior pituitary extracts			Group 2.	Groups 1 & 2.
Successful (8 days before to 17 days after term)		17	68.0%	76.0%
Failures (6 days before to 14 days after term)		8	32.0%	24.0%
Results in toxemia patients		17		
All received ergot and castor oil only				
Successful				
At term	6			
Past term (both seven days	2			
Before term (6 to 38 days)	8			
	16		(94%)	
Failures (26 days before term)		1	(6%)	
Ergot and artificial rupture of membranes (including 2 cases of toxemia)		26		
Shortest latent period 40 minutes				
Longest period (2 cases) 24 hours				
Average latent period—4 hours, 45 min.				
Cases varied 36 days before to 18 days after term				
Ergot and bougie insertion		2		
1 case latent period, 45 minutes (18 days after term)				
1 case latent period, 3 hours, 15 min. (14 days before term, toxemia)				
Total inductions using ergot		195		
Maternal Mortality	0			
Fetal mortality	3			

the primiparous group was four hours and the longest labor was thirty-six hours, the average being thirteen and one-half hours. In the multiparous group the shortest labor, excluding the case of intrauterine death of the fetus, was two hours and the longest labor was twenty-six hours, with the average being seven hours. Earlier, when the doses of ergot were given at shorter intervals, some patients experienced long pains, and some mild tetanic contractions were observed. However, these subsided in a few minutes and did not differ materially from the same condition observed on occasions when pituitrin has been used for the induction or stimulation of labor.

In one case in which partial placenta previa had not been recognized and in which labor was induced eighteen days past term, a vaginal hemorrhage of about 500 c.c. occurred seven hours after the second dose of ergot had been given. However, four, 2 minim doses of pituitrin, and two, 3 minim doses of thymophysin had been administered at intervals of one-half hour, immediately preceding the hemorrhage. At the time of the hemorrhage the cervix was 2 cm. dilated and about 40 per cent effaced. Cesarean section was performed immediately with a living baby and an uneventful convalescence for the mother.

Post-partum hemorrhage has not occurred in this series of cases.

The immediate repair of a lacerated cervix was done in 7 patients of the entire group. The incidence of subinvolution of the uterus and puerperal pyelitis was no more frequent than in a comparable group following spontaneous labor. There was one case of thrombophlebitis in the series, which occurred in the toxemia patient induced with bougies and ergot.

The condition of the cervix uteri at the postnatal interval examination has been used as an index of the remote morbidity. While it is impractical to describe in detail each case, the result of ergot induction on the late post-partum condition of the cervix has not been conducive to greater cervical pathology than in spontaneous labors. No third degree, a few second degree, and a number of first degree lacerations of the cervix were observed.

While the group of toxemia patients in this series is too small to be of statistical significance, a few observations may be worth noting. The blood pressure readings taken at fifteen-minute intervals, after the ingestion of ergot, revealed no elevation in the systolic and diastolic readings during a three-hour period. Although no definite water balance studies were made, the averages of the twenty-four-hour fluid intakes and outputs for the first two days post partum, in a group of patients induced with ergot, were no different than the averages in a group of patients in whom no ergot was used. The patients with toxemias had no greater uterine response to ergot than those without toxemia. This was observed carefully because of the known increase in uterine irritability of the toxemia patient to pituitrin administration.

Because of the above observations, and because of the high percentage of induced labors in this small series, the method would seem to be of distinct value in the toxemia patient, in which as Holman and Mathieu[10] have pointed out, the need for labor induction is the greatest.

DISCUSSION

Recognized medical opinion traditionally has condemned the use of ergot before or during labor; a condemnation justified by a review of the history of this use of the drug. On the other hand, a more critical review may indicate that the difficulties arose not so much from the use of ergot as from the various methods of preparation which allowed rapid deterioration or which lacked proper standardization. Criticism of the methods of standardization of ergot does not properly belong in this report. However, since the isolation of the alkaloid ergonovine, a combination of standardizations is sufficiently possible and practical to demand a reconsideration of the oxytocic values of ergot before and during labor. This is especially true if the use of posterior pituitary extracts continues in its general relationship to labor induction and stimulation as at present. Pituitrin as shown by Adair and others,[11] Hofbauer,[12] and others, adds serious elements of danger if used for the induction of labor in the toxemia patient. Briefly, this danger lies in the pressor and the antidiuretic actions of pituitrin and because of the increased sensitivity of the pregnant toxemia uterus to pituitrin stimulation. The desirability of oxytocic stimulation for induction of labor in the toxemia patient may be found in ergot which is free from the above-named disadvantages.

The choice of the whole ergot or the alkaloid ergonovine as the therapeutic agent is also an unsettled question. Ergonovine has been accepted as containing most of the oxytocic principle of ergot, but this oxytocic principle may be augmented or detracted from in desirability when used in combination with the other components of whole ergot. More pharmacologic evidence is needed to determine whether the components of ergot act as synergists, antagonists, or purely in an additive manner. Burn[13] maintains that the oxytocic action of ergonovine is prolonged by the remainder of the com-

ponent alkaloids of ergot. Ergot and ergonovine therefore, may exhibit the same possibilities of therapeutic choice as other drugs from which the active principles have been isolated.

CONCLUSIONS

1. Ergot has been used for the induction of labor on 195 occasions in 184 patients of whom 17 were toxemias of pregnancy.

2. There was no maternal mortality and no increase of maternal morbidity.

3. There were three fetal deaths, as described, and no increase of fetal morbidity.

4. Standardized powdered ergot* is stable and with carefully selected dosages is safe and effective for the purpose of labor induction.

REFERENCES

(1) *Marshall, T. H.:* Surg. Gynec. Obst. **64:** 542, 1937. (2) *Marshall, T. H.:* South. M. J. **28:** 125, 1935. (3) *West, R. A.:* Am. J. Obst. & Gynec. **36:** 241, 1938. (4) *Mosher, H. P.:* Laryngoscope **48:** 361, 1938. (5) Pharmacopoeia of the United States **11:** 147. (6) *Thompson, Marvin R.:* J. Am. Pharm. A. **22:** 736, 1933. (7) *Thompson, Marvin R.:* Personal communication. (8) *Allport, Noel L., and Porter, G. V.:* Quart. J. Pharm. & Pharmacol. **2:** 96, 1938. (9) *Hampshire, C. H., and Page, G. R.:* Ibid. **9:** 60, 1936. (10) *Holman, A. W., and Mathieu, A.:* West. J. Surg. **47:** 182, 1939. (11) *Adair, F. L., et al.:* Am. J. Obst. & Gynec. **30:** 466, 1935. (12) *Hofbauer:* Ibid. **36:** 522, 1938. (13) *Burn, J. H.:* Pharm. J. **134:** 357, 1935.

DISCUSSION

DR. GEORGE F. PENDLETON, Kansas City, Mo.—This paper stimulates two different emotions—caution and enthusiasm.

We induce labor either for the patient's benefit or for our own convenience. Moderate doses of castor oil and quinine can be safely used for this purpose in the normal woman. Neither drug will start uterine contractions before full gestation, unless there is an idiosyncrasy present. Neither drug is powerful enough in moderate doses to upset the normal physiology of labor. Time has proved this statement.

On the other hand, ergot is a more potent drug; it produces strong, prolonged contractions, and its action "hangs on." The effect is not a question of minutes but of hours.

Ergot stimulates all smooth muscles and especially those in the uterus and in the media coat of the arterioles. Is it safe to give ergot to the toxic patient and double the insult upon the already overirritated arterioles of that body? I believe that ergot is contraindicated.

The older doctors cautioned us that ergot given before the end of the third stage increased the number of retained placentas and disposed to contraction rings. They abandoned the use of ergot because of its profound, prolonged muscular action. Time has proved this statement by decreasing the number of cases of manual removal of placentas through small constriction "rings" of the so-called "difficult forceps" cases which, primarily, were often due to the latter.

The prolonged action of ergot brings up the question of increased intrauterine pressure, which ergot should markedly increase. By its use do we eliminate safety to gain speed?

The action of ergot upon the arterioles of the uterus should not be forgotten. Coupled with the moderate ischemia produced by the normal labor contraction, may it not cause serious effects on the fetus? Is this safety for the baby?

*The preparation used in these observations is in capsule form and was made by the Upsher Smith Co., Minneapolis, Minn.

In my private practice, the incidence of syphilis is 1 per cent. You justly say to me that I should run routine Wassermann tests to catch the one in one hundred cases. If I am to play as safely as that with syphilis, can I be as safe with the use of ergot in the induction of labor? If safety applies in the one condition, it should apply in all methods.

DR. FRED L. ADAIR, CHICAGO, ILL.—The question of the induction of labor really resolves itself into two points. I think all of us believe that there are certain cases that require induction of labor for the safety of the mother or baby. There are other cases which fall into quite a different group, that is a convenience group where you want to induce labor for the convenience of the patient or the physician. I am unalterably opposed to the induction of labor in the second type. I believe we have not recognized that labor begins before the onset of pain. There is a preparatory stage which precedes the actual onset of labor as characterized by labor pain. I believe the induction of labor prior to the completion of this introductory stage carries great danger.

About ergot, Dr. Davis and I and others have been interested in ergot for a number of years. We will agree with Dr. Ehrenberg as far as we have been able to determine that the oxytocic principle of ergot properly used has no deleterious effect on the blood pressure. It is difficult for me to understand why such a drug as powdered ergot, so variable in its potency, should be used to induce labor where we have a known oxytocic principle with exact dosage. It is the oxytocic principle we are concerned with in the induction of labor. Some ergot preparations contain no oxytocic principle and others possess a large amount. The method of standardization used by the Bureau of Standards is no indication of the amount of oxytocic principle ergot contains, because the oxytocic principle is not tested by the methods used in the Bureau, thus the amount of the oxytocic principle in different preparations may vary enormously. It seems to me if ergot is indicated in the induction of labor one must use a preparation whose oxytocic principle can be determined exactly.

DR. EHRENBERG (closing).—I cannot agree with Dr. Pendleton when he states that time has proved quinine a safe drug when used for the induction of labor, and the literature of the last few years will bear me out. His generalizations on the use of ergot are the old, time worn, familiar statements and are not pertinent to this report, in as much as he makes no differentiation as to the types of preparation of the ergot. One cannot discuss ergot without first qualifying the preparation of ergot being used as to stability, standardization, and ergonovine equivalent strength. Dr. Adair's criticism of the use of powdered ergot in place of the oxytocic principle of the drug may be justifiable. However, there is some indication that the whole ergot acts more favorably than the oxytocic principle alone. More work will be necessary to prove or disprove this hypothesis.

We have shown, with the ergot we used, the manner in which the oxytocic principle or ergonovine equivalent strength has been arrived at, and, although this varies by approximately 25 per cent, the variation is no greater than that allowed for various posterior pituitary extracts. The statistical material in this report is, we believe, worthy of reporting, but our real reason for presenting this report is because we feel that the use of ergot before and during labor should be revalued in view of the more accurate method of standardization made possible by the discovery of the oxytocic principle.

INTRAUTERINE DEATH OF THE FETUS AFTER THE TWENTY-EIGHTH WEEK*

HENRY BUXBAUM, M.D., F.A.C.S., AND ISADORE C. UDESKY, B.S., M.D.,
CHICAGO, ILL.
(From the Service of the Chicago Maternity Center)

OUR purposes in investigating intrauterine death of the fetus were: First, to ascertain as far as possible the most common etiologic factors producing this condition; second, to determine the mechanism by which death is produced; and third, to discover the best means of preventing this complication. Finally, by a critical analysis of our cases, we hoped to come to some definite conclusions regarding the most satisfactory method of managing this rather common complication, with the least possible harm to the mother.

The cases for this study were taken from the records of the Chicago Maternity Center, an out-patient clinic where practically all the confinements are conducted in the patients' homes. In the selection of these cases we utilized only those in which the fetus was known to have died after the twenty-eighth week of gestation, but before the onset of labor. In all, there were 128 cases conforming to this criterion. During the same period of time we had 16,834 deliveries; therefore, the incidence of occurrence of intrauterine fetal death was 1 in 131 cases, or 0.7 per cent.

The ages of the patients in this group varied from 15 to 44 years and were divided as follows:

15 to 19 years	10 cases
20 to 29 years	50 cases
30 to 39 years	60 cases
40 to 44 years	8 cases

From this it may be gathered that intrauterine death of the fetus is more likely to occur in women over thirty years of age, and more commonly in the third decade of life. This is of some slight significance when we realize that the average age of the patients in our clinic is 20 years.

In studying the distribution of cases according to parity, we find the situation as revealed in Table I.

TABLE I

Para	i	ii	iii	iv	v	vi	vii	viii	ix	x
No.	23	12	11	11	10	18	10	9	8	16

Thus, 23, or 17.9 per cent, were primiparas and 105, or 82.1 per cent, were multiparas. A review of our clinic records shows that 75 per cent of all our deliveries occur in women of para v or less, and the remaining 25 per cent in para vi or more. It then becomes readily apparent from an analysis of Table I that intrauterine fetal

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Mo., November 2 to 4, 1939.

death is relatively more common in the higher parities, when we take into consideration that 50 per cent of these cases occurred in women of para vi to para x.

The duration of gestation is revealed in Table II.

TABLE II

Weeks	28 to 31	32 to 35	36 to 39	40 to 43	Over 44	No record
Number	7	24	50	36	3	8

This table shows that while, as we would expect, the greatest number of babies died between the thirty-sixth and thirty-ninth weeks of gestation, approximately one-third of these babies were postmature, as judged by the standard method of estimating due date. This fact will be taken into consideration in discussing the prevention and treatment of this condition.

Since 30 of these patients were referred to us for delivery by an outside agency, no definite records were available. In 48 cases the fetal heart tones were still present at the last prenatal visit, so that in these 78 cases it was impossible to estimate the exact time that fetal death occurred. Although many of the latter 48 patients gave a history of not having felt fetal movements for a week or longer, this information was considered too inaccurate to be utilized in attempting to determine the length of time after death that the fetus was retained in the uterus. In the remaining 50 cases, the length of time the babies were retained in utero after the fetal heart tones were recorded as absent is shown in Table III.

TABLE III

Days	Less than 7	7-14	14-21	21-28	28-35	35-42	42-56
Cases	35	6	1	3	2	1	2

The great majority of these patients complained of no systemic manifestations directly attributable to the retention of a dead fetus in utero. A few patients did complain of nausea, anorexia, chills, and a bad taste in the mouth. Thus, the information gained from Table III is of extreme importance, since it shows that a dead fetus can be retained in the uterus for a period of time varying from one to 56 days, with no serious untoward effect on the mother.

The obstetric histories in these patients were studied to find out with what frequency intrauterine death of the fetus occurred in women who have had some other obstetric accident, as abortion or stillbirth.

TABLE IV. OBSTETRIC HISTORY

Abortions per patient	1	2	3	4	5	6	7	8
Number of cases	17	10	4	1	2	0	2	1
Stillbirths per patient	1	2	3	4	5	6	7	8
Number of cases	8	2	1	1	0	0	1	0

Table IV reveals the tendency for intrauterine death of the fetus to occur in women who give a history of repeated abortions or stillbirths.

As to the sex of the fetus, there were 81 males and 47 females in the entire series, a preponderance of males over females of two to one. The cases occurred equally as often in the white as in the colored races, despite the fact that approximately 33 per cent of our clinic cases are colored patients, indicating a much higher incidence of intrauterine fetal death in the colored patients.

Of the 79 patients registered with us and followed in our prenatal clinic, positive serology was obtained in 14, an incidence of 17 per cent.

Thus of the 69 cases in which the cause of the death of the fetus could be determined, we found that 45 of the deaths were due to some constitutional disease of the mother. The most important of these diseases were syphilis, late

TABLE V. CAUSE OF FETAL DEATH

MATERNAL CAUSES		FETAL CAUSES		UNKNOWN
Syphilis	18	Cord pathology	11	59
Late toxemias	12	Monsters	5	
Abruptio placentae	9	Polyhydramnios	2	
Diabetes	6	Volvulus and gangrene of the bowel	1	
Intrapartum sepsis	2	Dubois' abscess of thyroid	1	
Urinary tract infections	1			
Bandl's ring	1			

toxemias of pregnancy, including chronic nephritis, and diabetes mellitus. In 20 other cases, the cause of death was directly attributable to fetal pathology. Inasmuch as practically all of these babies were in various stages of decomposition, with the exception of the two with abscess of the thyroid and gangrene of the bowel, autopsy was of no value in determining the cause of death of the fetus.

The onset of labor was spontaneous in 118, or 92.1 per cent, of the cases. Medical induction was resorted to in 9 cases, or 7.3 per cent. Eight of these inductions were done for coexisting severe toxemia of late pregnancy which did not respond to conservative management. Bag induction was resorted to in one case for a fulminating toxemia, associated with a complete abruption of the placenta with a blood loss of 1,500 c.c.

The termination of labor was spontaneous in 111 cases, or 86.8 per cent, and operative measures were employed in the remaining 17 cases, or 13.2 per cent. The types of operations performed were: Low forceps, 1; craniotomy, 13; vaginal hysterotomy, 1; breech extraction, 1; and version followed by extraction, 1.

The duration of labor was from one to eighteen hours in 98 cases, over eighteen hours in 17 cases, and precipitate in 13 cases, where the baby was born before the arrival of the doctor. The average duration of labor for the entire series was eleven hours and forty-one minutes. There were no maternal deaths in this series. One hundred and sixteen of these women had an uneventful puerperium and were discharged on the tenth day. The other 12 cases were considered febrile, a morbidity rate of 9.3 per cent. A very brief analysis of these cases showed one case of severe post-partum pyelitis, one case that was terminated by Dührssen's incisions and craniotomy after a twenty-nine hour labor, one case of a transverse presentation and prolapse of the cord, for which podalic version was done, and an eight and one-half pound baby extracted. Uterine exploration revealed a rupture in the lower uterine segment, and a subtotal hysterectomy was performed. After a stormy convalescence, the patient recovered. One patient had irregular pains for three days, at the end of which time her temperature rose to 102° F. and her pulse to 140, associated with a foul vaginal discharge. She was delivered by vaginal hysterotomy and craniotomy. The next patient delivered spontaneously; after a febrile course for twenty-one days she had a delayed post-partum hemorrhage which was controlled by intravenous ergonovine. Retained secundines were expelled at this time and her temperature returned to normal. One patient had multiple fibroids which became extremely tender after delivery; under conservative management the infection was controlled. Another patient contracted mumps and ran a febrile course for a few days. The remaining six patients had mild intrauterine infections and recovered within fourteen to twenty-four days. We wish to mention at this time that although our apparent maternal morbidity was only 9.3 per cent, this by no means can be considered accurate, inasmuch as all these patients were delivered at home where temperature readings are recorded only once a day on the average patient, and usually in the morning. The twelve cases herein cited were those in which post-partum pathology was easily discernible.

Based on an estimated blood loss of 500 c.c. or more, post-partum hemorrhage occurred in seven cases or an incidence of 5.4 per cent. This was of considerable interest to us in view of the existing consensus of opinion that excessive bleeding rarely follows the birth of a macerated baby.

RECOMMENDATIONS

All women who give a history of previous abortions or stillbirths should have a careful work-up, including routine serology, complete blood studies, and blood chemistry with particular reference to non-protein nitrogen retention and blood sugar. A basal metabolism test should be done and, if indicated, thyroid extract should be given throughout the duration of pregnancy.

Antisyphilitic therapy to be most effective must be started early and continued throughout the duration of pregnancy. The urine must be carefully examined for albumin and blood at frequent intervals throughout the course of treatment.

Diabetic patients should be under the joint supervision of an obstetrician and a competent internist. When a diabetic patient is pregnant and gives a history of having had one or more previous stillbirths, we should seriously consider terminating the case by a cesarean section about the thirty-eighth week of pregnancy. All other pregnant diabetic women who are well controlled and present no signs of cephalopelvic disproportion can be delivered from below.

Intrauterine death of the fetus per se calls for no active interference. In the absence of urgent maternal indications, labor should not be induced by either medical or mechanical means. Our specific objections to medical induction in this type of case are that it is quite often unsuccessful and, moreover, may actually expose the patient to danger by causing the membranes to rupture without immediately initiating labor. Our objections to all forms of mechanical inductions are the greatly increased dangers brought about by the introduction of virulent organisms from without. This is especially true when we realize that a uterus harboring a macerated fetus offers an excellent culture medium for bacterial growth. In conducting the actual labor, operative interference should only rarely be resorted to. These cases should be terminated with the least possible injury to the mother, therefore episiotomies should seldom if ever be done. If there is some complication, such as toxemia or intrapartum sepsis, that endangers the mother's life and operative interference is indicated, the procedure of choice is a mutilating operation, usually craniotomy.

SUMMARY AND CONCLUSIONS

1. Intrauterine death of the fetus in our clinic occurred 128 times in 16,834 deliveries, an incidence of 0.7 per cent.

2. This complication occurs more frequently in women over thirty years of age.

3. Seventy per cent of our patients went into labor spontaneously within seven days after the known death of the fetus. The remaining 30 per cent did not go into labor for a period varying from seven to fifty-six days.

4. There is a marked tendency for this complication to occur in patients having a previous history of repeated abortions or stillbirths.

5. Despite the fact that fewer deliveries occurred in the para v to para x group, this group still accounts for 50 per cent of the total

number of fetal deaths in this series, indicating an increased tendency for intrauterine death of the fetus to occur in the higher parities.

6. The most common causes for death of the fetus during pregnancy, where such causes could be ascertained, were syphilis, late toxemias of pregnancy, including chronic nephritis and diabetes.

7. Spontaneous onset of labor occurred in 92.1 per cent, and in 7.9 per cent labor was induced because of maternal complications.

8. Delivery occurred spontaneously in 86.8 per cent, and was terminated by operative means in 13.2 per cent. However, 13 of these operative cases were craniotomies, most of which were done for teaching purposes.

9. One hundred sixteen, or 90.7 per cent, of these patients had a normal uneventful convalescence.

10. There were no maternal deaths in this series.

11. We have unequivocally demonstrated that intrauterine death of the fetus, regardless of the period of retention in the uterus, produces no serious untoward effects on the mother, and if managed conservatively should be attended by no maternal mortality.

8 South Michigan Avenue

DISCUSSION

DR. J. C. LITZENBERG, Minneapolis, Minn.—The reduced birth rate in the United States calls for the conservation of as many as possible of the nearly 100,000 babies who are born dead. This has not only a medical significance to us who are responsible for the survival of the babies, but it has an economic value.

How to prevent these intrauterine deaths is most important. Few of the patients are subjected to treatment, but there are several things that may be done to save most of these babies or at least a large percentage. Take the 77,000 who die in utero in the United States. The figures given here were, I believe, 128 cases in one community, so if that percentage were allotted to every community, it would probably account for most of the intrauterine deaths. The figures are astounding, 77,000. How many of these babies can be saved? It is very evident if we fulfill our function as careful obstetricians that many of these babies can be saved.

Care in regard to certain conditions will result in the reduction in number of uterine stillbirths. The chief of these are:

1. *Syphilis.*—This emphasizes the necessity of having a Wassermann reaction and a clinical diagnosis of syphilis in all such women, if we are to detect syphilis in the pregnant woman. If all syphilitic pregnant women are treated continuously until they come to labor, most of these babies will be saved as seen in the authors' table.

2. *Toxemia.*—Many of these babies can be saved by judicious treatment of the toxemias of pregnancy.

3. *Diabetes.*—These women must be watched with particular care, because if they are neglected in their treatment, we will have many stillborn babies.

4. *Pyelitis.*—One of the most neglected of the causes is urinary tract infection.

DR. GEORGE KAMPERMAN, Detroit, Mich.—Conservatism in the handling of women with dead fetuses must be emphasized. The essayists have noted that mechanical induction is often serious because the dead pregnancy is a fertile field for the growth of microorganisms. When we introduce a foreign body into the uterus we must remember a dead fetus is already a foreign body. If a foreign body in the uterus does not start labor, we will not help by adding another foreign body.

DR. W. A. RUCH, MEMPHIS, TENN.—I wonder if in their series the authors found any cases of torsion of the cord, for in the last year I have seen three cases, one in a primipara. All the women had normal courses and negative Wassermann reactions, but at about the seventh month there was a cessation of fetal life. After two weeks, two of these patients responded to medical induction, but the other one did not, and we used a bougie. In each one of these cases there was nothing abnormal about the fetus except a torsion of the cord about one inch from the baby's body.

DR. FRED L. ADAIR, CHICAGO, ILL.—Dr. Edith Potter in our clinic analyzed some of the ante-partum deaths with which she has come in contact during her pathologic work. We have had in all 207 ante-partum fetal deaths; 81 were at term, 102 premature and 24 previable. It is interesting that in this group no maternal complication was diagnosed in 44 per cent. The contributory factors as far as the mother was concerned were toxemia and hemorrhage in 44.4 per cent. In this particular group the incidence of syphilis was rather low, 2.9 per cent. We had more deaths due to cord entanglement, 5.3 per cent. In the miscellaneous group, which included hydramnios, cardiac disease, pernicious anemia and hyperthyroidism, the percentage of deaths was 3.4. The fetus was normal or macerated in 35.8 per cent and malformed in 8.2 per cent. The toxemic group ran 20.8 per cent with the convulsive type in 1.4 per cent. We had placental detachment in 11.1 per cent, placenta previa in 3.4 per cent, placental detachment with toxemia in 7.7 per cent.

Hydramnios and other conditions in the miscellaneous group made up a very small percentage, showing there were diverse causes that contributed to the ante-partum deaths, some preventable, others not preventable. It is the preventable group in which we are interested from the standpoint of saving lives. The other presents a scientific interest and is a matter of academic concern, such as a seriously malformed fetus which we cannot save and would not want to save if we could.

TABLE I. MATERNAL COMPLICATIONS ASSOCIATED WITH ANTE-PARTUM DEATH OF THE FETUS

	TERM		PRE-MATURE		PRE-VIABLE		TOTAL		PER-CENTAGE	
No maternal complications		32		46		13		91		44.0
Fetus normal or macerated	25		37		12		74		35.8	
Fetus malformed	1		9		1		17		8.2	
Toxemia and hemorrhage		34		48		10		92		44.4
Toxemia	15		20		8		43		20.8	
Eclampsia			3				3		1.4	
Abruptio placentae	13		8		2		23		11.1	
Placenta previa	3		4				7		3.4	
Abruptio placentae and toxemia	3		13				16		7.7	
Syphilis (only 3 infants diagnosed as syphilitic)		3		3				6		2.9
Cord entanglements		7		3		1		11		5.3
Miscellaneous		5		2				7		3.4
Hydramnios	3						3		1.4	
Cardiac			1				1		0.5	
Pernicious anemia			1				1		0.5	
Hyperthyroidism	2						2		1.0	
Total		81		102		24		207		100.0

DR. DAVID A. HORNER, CHICAGO, ILL.—The reported cases showed no symptoms attributable to the dead fetus itself. That I brought out several years ago and showed that it is contrary to what the textbooks teach. Such symptoms as

headache, bad taste in the mouth, and fever were absent in the essayists' series and also absent in the series I presented several years ago.

As to the things to do if babies have died in utero, the answer is, there is nothing to do. The patient usually makes the diagnosis herself if she is beyond the period of viability. She feels no active movements, reports that to the doctor, and he cannot hear the heart tones, which bears out the diagnosis of a dead baby which the mother has already made. The failure of the uterus and fetus to grow also indicates that the baby is death, and no harm is produced by allowing the baby to remain until nature takes care of it.

About the baby that dies in the latter part of the period of gestation, from being beyond term—if there is such a thing as an over-term baby or an overdeveloped baby, the less we do about it the less trouble we get into. While the size of the baby is an indication of its being fully developed, the only quite safe thing we can do is what we were taught not to do, that is a quick cesarean section. The use of pituitrin and bags, rupturing the membranes only make a bad matter worse. Bad results invariably follow too much manipulation. It is much easier, quicker, cleaner, and safer, I believe, in the right hands to do a cesarean section.

DR. UDESKY (closing).—In answer to Dr. Ruch's question whether we had observed any case of torsion of the cord, our diagnosis of most of the cases of cord pathology was a forelying cord or a cord lying in front of the baby's head. In answer to his other question of how long we would advise any one to wait before inducing labor if the baby is dead, our policy is strictly one of nonintervention. In the absence of maternal indications we do not induce labor.

CHRONIC CERVICITIS*

Report of the Committee on Clinical Affairs of the Central Association of Obstetricians and Gynecologists

THIS report is based on the questionnaire circulated by the Committee during 1939 to the total membership of the Association. Reference to specific numbers of patients treated and other features requiring careful review of records, with the exception of complications, were purposely avoided.

From Table I it will be seen that, in general, it is felt that chronic cervicitis is a lesion of considerable importance in relation to body functions outside the pelvic viscera, as well as being the cause of significant changes in the pelvis.

It will be noted that the replies to all of these questions indicate that a majority are of the opinion that chronic infection of the cervix can be the causative agent of many important symptoms. It is of interest to note, however, that chronic cervicitis is considered more important as a focus of infection than as an etiologic factor in cancer.

Opinion concerning etiology (Table II) indicates that birth trauma is considered by far the most important causal factor. The remainder of those replying indicated that nonspecific infections rate second and specific infections third. The other causes mentioned were of minor importance.

Questions relative to the investigation of cervicitis (Tables IIIA and B) revealed that the majority did not feel that smears were important and that biopsy was indicated in only a few cases. Most of the men were of the opinion

*Presented at the Eleventh Annual Meeting of the Central Association of Obstetricians and Gynecologists, Kansas City, Co., November 2-4, 1939.

TABLE I. SIGNIFICANCE OF CHRONIC CERVICITIS

QUESTION	YES		NO	
	NO.	PER CENT	NO.	PER CENT
Chronic cervicitis may be the cause of dysmenorrhea	80	63	47	37
Chronic cervicitis may be the cause of dyspareunia	84	64	47	36
Chronic cervicitis may be the cause of urinary symptoms	83	65	43	35
Chronic cervicitis may be the cause of pelvic pain	114	87	17	13
Chronic cervicitis may be the cause of backache	118	89	14	11
Chronic cervicitis may be the cause of sterility	129	97	4	3
Is chronic cervicitis important as a precancerous lesion	80	61	50	39
Is chronic cervicitis of importance as a focus of infection	103	78	28	22

TABLE II. ETIOLOGY OF CHRONIC CERVICITIS

MOST IMPORTANT ETIOLOGIC FACTOR	NO.	PER CENT
Birth trauma	97	73
Nonspecific infections	26	19
Specific infections	11	8

TABLE IIIA. DIAGNOSIS OF CERVICITIS

	YES		NO	
	NO.	PER CENT	NO.	PER CENT
Are stained smears important in the study of chronic cervicitis	55	41	79	59

	ALL CASES		MOST CASES		FEW CASES	
	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT
Biopsy is indicated in chronic cervicitis	8	6	35	26	91	68

TABLE IIIB. DIAGNOSIS OF CERVICITIS

	GREAT VALUE		MODERATE VALUE		LITTLE VALUE	
	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT
Schiller test. Value in chronic cervicitis	9	7	52	38	74	55
Colposcope. Value in chronic cervicitis	5	4	31	28	75	68

that the Schiller test and colposcope added little to the investigation of this condition. It would seem, therefore, that, in general, gross inspection of the lesion was considered adequate to make the diagnosis and to decide on proper treatment.

It will be seen from Table IV that by far the most common form of treatment used is actual cautery. The next in order of frequency are the three operative procedures: Sturmdorf amputation, trachelorrhaphy, and conization, which occupy about comparable positions. Cautery with chemical agents occupied a position quite similar to these three procedures, and cautery under anesthesia is next in importance. The remainder are used much less frequently.

TABLE IV. USE OF VARIOUS FORMS OF TREATMENT FOR CHRONIC CERVICITIS

TREATMENT	YES		NO	
	NO.	PER CENT	NO.	PER CENT
Cautery	127	94	8	6
Sturmdorf amputation	77	57	58	43
Trachelorrhaphy	72	53	63	47
Conization	68	50	67	50
Chemical cautery	66	49	69	51
Cautery under anesthesia	54	40	81	60
Hysterectomy	39	29	96	71
Schroeder amputation	38	29	97	71
Antiseptics	36	27	99	73
Coagulation	34	25	101	75
Diathermy	10	7	125	93

The incidence of complications following treatment was surprisingly large. A total of 685 complications attributable to treatment were reported. Of these, 276, or 40 per cent, occurred following cautery of the cervix. The list of complications recorded and their frequency is shown in Table V.

TABLE V. COMPLICATIONS FOLLOWING TREATMENT OF CHRONIC CERVICITIS

COMPLICATION	NUMBER
Hemorrhage	259
Stenosis of cervix	208
Upper genital tract infection	148
Cancer	16
Pyometria	12
Endometriosis	10
Cystitis	6
Abortion	7
Phlebitis	3
Prolonged labor	2
Dysmenorrhea	2
Others (single cases)	12
Total	685

While the high incidence of complications following cautery is partially explained by the more frequent use of this procedure, the number of complications seemed out of proportion although no comparative figures were available. An analysis of the complications following cautery revealed that upper genital tract infection (81), hemorrhage (80), and stenosis (80) made up 87 per cent of this group. An analysis of the three chief complications, hemorrhage, stenosis, and infection, revealed that cautery was responsible in 35 per cent, 38 per cent, and 54 per cent, respectively.

Since there has been considerable discussion concerning the relative merits of conization and Sturmdorf amputation, a comparison of complications following these was thought desirable (Table VI). It will be noted that the total number

TABLE VI. COMPLICATIONS FOLLOWING CONIZATION AND STURMDORF AMPUTATION FOR CHRONIC CERVICITIS

COMPLICATION	CONIZATION	STURMDORF
Hemorrhage	60	38
Stenosis of cervix	13	35
Upper genital tract infection	13	6
Others	8	7
Total	94	86

of complications is about the same. There is a higher incidence of hemorrhage and infection with conization, while the incidence of stenosis of the cervix following Sturmdorf operation is sufficiently high to almost equalize this.

In view of the large number of complications reported, it is of interest to study the opinion concerning contraindications to treatment (Table VII). It will

TABLE VII. CONTRAINDICATIONS TO TREATMENT OF CHRONIC CERVICITIS

PELVIC CONDITION	NO CONTRAINDICATION TO ANY TYPE OF TREATMENT		CONTRAINDICATION	
	NO.	PER CENT	NO.	PER CENT
Retroversion of the fundus uteri	108	80	27	20
Inactive infection of upper genital tract	91	68	44	32
Active infection of upper genital tract	4	3	131	97

be seen that retroversion which has been emphasized by many as a contraindication is regarded as insignificant by 80 per cent of those replying. The opinion concerning infection as a contraindication seems about what should be expected. The fact, however, that 97 per cent avoided treatment in active infection and yet 148 acute infections attributable to the treatment are reported, suggests that the method of diagnosis of infection of the upper genital tract or its activity may be lacking in efficiency.

An analysis of the types of treatment believed to be contraindicated in retroversion showed that chemical cautery, coagulation, and conization were most objectionable, while in infection, these plus the various surgical procedures, as trachelorrhaphy, Sturmdorf amputation, and Schroeder amputation, are mentioned most frequently.

SUMMARY

This questionnaire study suggests that cervicitis is generally regarded as a lesion which can be of importance to the individual, both locally and in relation to various systemic conditions. It would seem that gross inspection is the chief method of diagnosis and that the various special instruments and tests recommended in its study are regarded by most as of little value. The large number of complications reported, most of which occurred following cautery of various types, should prompt us to improve our methods of diagnosis and treatment of this very common condition.

The Committee is grateful to those members who cooperated in this study. The investigation has been interesting and profitable to us, and we hope that it may be of some value to the Association.

Norman R. Kretzschmar, M.D.
L. M. Randall, M.D.
John Brewer, M.D.

PREMATURE INFANT MORTALITY*

A Statistical Study of Factors Influencing Mortality in 453 Infants Weighing Less Than 2,500 Grams

Robert M. Grier, M.D., and Herbert O. Lussky, M.D., Evanston, Ill.
(From the Departments of Obstetrics and Gynecology, and Pediatrics, Northwestern University Medical School and Evanston Hospital)

ALTHOUGH the incidence of premature births at the Evanston Hospital for a ten-year period was only 5 per cent, the deaths in this small number (113) accounted for 65 per cent of the gross neonatal mortality (174). It is obvious therefore, that any marked reduction in the gross neonatal mortality rate must be brought about by a reduction in premature births or by reducing the number of deaths in this group. In this study we have attempted to analyze certain factors which we thought might have an influence on mortality.

There were 8,456 babies delivered at the Evanston Hospital in the years 1929 to 1938 inclusive. Of these, 5 per cent, or 453, weighed 2,500 Gm. or less. It is this small group which accounted for 65 per cent of the total neonatal deaths. Of the 174 neonatal deaths, 113 were in this group. All of these 453 infants were not really premature. Many of them were from multiple pregnancies and were small even though they were at or near term. We have divided the babies into the groups according to weights; under 1,000 Gm., 1,001 to 1,500, 1,501 to 2,000, and 2,001 to 2,500 Gm., and a fifth group in which are placed those infants whose weights were not recorded. Any further division would result in such small numbers in each group that there would be errors due to sampling. Our results are summarized in ten tables.

Table I and Fig. 1 clearly show the close correlation between the weight of infants at birth and mortality. Ninety-seven per cent of those weighing 1,000 Gm. or under died, while of those between 2,000 and 2,500 Gm., only 8 per cent died.

Table I. Relation of Birth Weight to Infant Mortality
Mortality for Weight Groups

GROUPS	TOTAL	LIVED	DIED	PER CENT DIED
Under 1000 Gm.	33	1	32	97
1001 to 1500 Gm.	38	13	25	65
1501 to 2000 Gm.	91	63	28	31
2001 to 2500 Gm.	285	262	23	8
Weight not stated	6	1	5	83
Total	453	340	113	25

Table II and Fig. 2 show the intrauterine age of the babies at birth. It is readily seen that most of those under thirty weeks' gestation weighed 1,500 Gm. or less, and practically all of those thirty-four weeks' gestation or more weighed over 1,500 Gm. In the graph, the mortality curve for intrauterine age at birth and that for weight are nearly parallel. Since intrauterine age could not be accurately determined, we have taken weight as the most reliable single factor in determining prematurity.

*Presented at a meeting of the Chicago Gynecological Society, October 20, 1939.

In further tables we wish to show the influence of other factors on mortality. According to Breese, "unless the weight factor is eliminated, effect of other factors influencing mortality is likely to be obscured, because of the very marked correlation between weight and mortality." We have attempted to eliminate this by the method described by this author, as follows: "using the mortality in each weight class of the entire group as a base line, we obtained the expected mortality for each factor as follows: the number of cases in each weight class is multiplied by

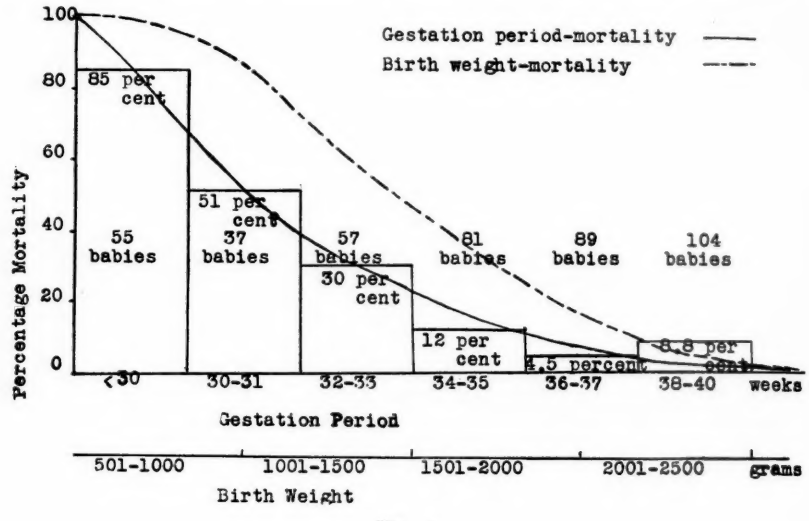

Fig. 1.

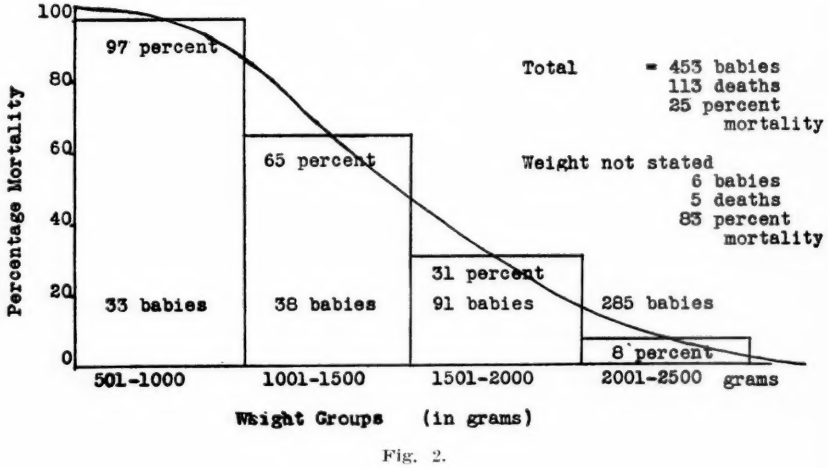

Fig. 2.

the mortality rate for that weight group; the sum of all these is then divided by the total number of cases studied. This will give the expected mortality percentage. This can then be compared with the actual mortality and difference between the two noted."

For example, let us find the expected mortality for babies born during the thirtieth and the thirty-first weeks by looking at Table IIA.

In our series there were 37 infants born at this intrauterine age. Nineteen of them died, giving a true mortality of 51.0 per cent. We find then that there was a difference between the true and expected mortality.

TABLE II. PERIOD OF GESTATION

WEEKS OF GESTATION	UNDER 1,000 GM.		1,001 TO 1,500 GM.		1,501 TO 2,000 GM.		2,001 TO 2,500 GM.		NOT STATED		TOTAL			PERCENTAGE	
	L*	D	L	D	L	D	L	D	L	D	L	D	T	TRUE	EXPECTED
38-40	0	0	0	0	2	2	93	7	0	0	95	9	104	8.5	8.8
36-37	0	0	1	1	14	3	70	0	0	0	85	4	89	4.5	13.6
34-35	0	0	2	0	13	5	56	5	0	0	71	10	81	12.0	14.5
32-33	0	1	4	2	18	7	18	7	0	0	40	17	57	30.0	25.0
30-31	1	0	3	8	9	9	5	1	0	1	18	19	37	51.0	40.0
Under 30	0	28	3	14	1	1	3	0	1	4	8	47	55	85.0	78.0
Not stated	0	3	0	0	6	1	17	3	0	0	23	7	30	23.0	22.0

*L, lived; D, died; T, total.

TABLE IIA. TRUE AND EXPECTED MORTALITY

WEEKS OF GESTATION	WEIGHT IN GRAMS					TOTAL NO. OF BABIES	DIED
	500-1,000	1,001-1,500	1,501-2,000	2,001-2,500	NOT STATED		
30-31	1	11	18	6	1	37	19
Weight-Mortality per cent	97	65	31	8	83		

True Mortality: $\frac{19 \times 100}{37} = 51.0\%$

Expected Mortality: $\frac{1501}{37} = 40.5$ per cent

97 × 1	=	97
65 × 11	=	715
31 × 18	=	558
8 × 6	=	48
83 × 1	=	83
37		1501

PARITY AND SEX

While there were more primiparas than multiparas, the true infant mortality for each group was 24.6 and 25.4 per cent, respectively, a negligible difference. Table III shows there was practically no difference between the true and expected mortality. From this it would seem that parity had no influence on fetal mortality.

It is a well-known fact that more male than female infants are born. In our series of premature infants the reverse was found; 239 females to 214 males. Nevertheless there were more deaths in males than in females, with a true mortality for males of 30 per cent and for females 21 per cent. Eliminating the weight factor, the expected mortality was the reverse; 21.9 per cent for males and 24.7 per cent for females. While this fact is interesting and has been noted by other investigators, no explanation will be attempted (see Table IV).

RELATION OF INCIDENTS OF LABOR AND DELIVERY TO MORTALITY

To determine the effect of length of labor on mortality, an analysis was made of periods of five hours. The true and expected mortalities were essentially the same. But curiously enough the hightest rate was found in those with the shortest labor or no labor at all, for example, when delivery was by elective cesarean section. In the groups in which labor was eleven to fifteen hours, or over twenty-one hours, the mortality was the lowest. This can possibly be explained best on the fact that in the former many of the cesarean sections were done because of serious maternal pathology, such as abruptio placentae. In the short labors, contractions were probably frequent, long and violent, with consequent injury to the babies.

A consideration of the effect of the method of delivery on mortality revealed that the true and expected mortalities were very nearly the same. The lowest mortality was in delivery by forceps. The same observation has been made in similar investigations. The highest mortality occurred in the group delivered by version and extraction. This, no doubt, is due to the fact that we rarely do this operation except in emergencies, such as placenta previa. The next highest rate was in the spontaneous deliveries. The mortality rate for cesarean section was slightly higher than average, but is not unduly high, when one considers that it was done frequently for serious maternal pathology.

EFFECT OF SEDATIVES AND ANESTHESIA

It has long been the belief that sedatives and anesthesia have a harmful effect on the newborn. Over one-third of the mothers of these babies received some form of sedation as well as anesthesia in labor. Nevertheless the mortality for these babies was only 19 per cent, which was the same as the rate for infants whose mothers has "local infiltration only." This is lower than the gross average mortality, 25 per cent. In the groups in which "sedative only" and "general anesthesia only" were used the mortality was 26 and 27 per cent, respectively. The group in which "no medication or anesthesia" was given, was the highest, 44

TABLE III. RELATION OF PARITY TO INFANT MORTALITY

	UNDER 1,000 GM.		1,001-1,500 GM.		1,501-2,000 GM.		2,001-2,500 GM.		NOT STATED		TOTAL			PERCENTAGE	
	L	D	L	D	L	D	L	D	L	D	L	D	T	TRUE	EXPECTED
Primiparas	0	18	9	11	37	17	143	11	1	5	190	62	252	**24.6**	25.5
Multiparas	1	14	4	14	26	10	115	12	0	0	146	50	196	**25.5**	24.4
Not stated	0	0	0	0	0	1	4	0	0	0	4	1	5	**20.0**	12.6

TABLE IV. MALES AND FEMALES

	UNDER 1,000 GM.		1,001-1,500 GM.		1,501-2,000 GM.		2,001-2,500 GM.		NOT STATED		TOTAL			PERCENTAGE	
	L	D	L	D	L	D	L	D	L	D	L	D	T	TRUE	EXPECTED
Males	0	16	4	14	25	17	122	13	0	3	151	63	214	**30**	24.9
Females	1	16	9	11	38	11	140	10	1	2	189	50	239	**21**	24.7

TABLE V. LENGTH OF LABOR

	UNDER 1,000 GM.		1,001-1,500 GM.		1,501-2,000 GM.		2,001-2,500 GM.		NOT STATED		TOTAL			PERCENTAGE	
	L	D	L	D	L	D	L	D	L	D	L	D	T	TRUE	EXPECTED
Under 5 hours	0	15	3	13	18	11	92	5	0	1	113	45	158	**28**	25
6-10 hours	1	6	2	9	23	8	77	6	0	2	103	31	134	**23**	21
11-15 hours	0	2	1	1	3	1	29	3	1	0	34	7	41	**17**	19
16-20 hours	0	2	1	1	4	1	18	3	0	1	23	8	31	**26**	23
21 plus	0	3	0	0	3	1	14	0	0	0	17	4	21	**19**	25
No labor	0	3	5	0	9	6	26	6	0	1	40	16	56	**28**	25
Not stated	0	1	1	1	3	0	6	0	0	0	10	2	12	**17**	31
Total	**1**	**32**	**13**	**25**	**63**	**28**	**262**	**23**	**1**	**5**	**340**	**113**	**453**	**25**	**24**

TABLE VI. TYPE OF DELIVERY

	UNDER 1,000 GM.		1,001-1,500 GM.		1,501-2,000 GM.		2,001-2,500 GM.		NOT STATED		TOTAL			PERCENTAGE	
	L	D	L	D	L	D	L	D	L	D	L	D	T	TRUE	EXPECTED
Not stated	0	0	0	0	2	0	5	0	0	0	7	0	7	**0**	14
Version and extraction	0	1	1	3	1	0	6	1	0	0	8	5	13	**38**	33
Breech and extraction	0	4	2	5	5	2	26	1	0	0	33	12	45	**27**	24
Cesarean section	0	3	5	0	9	6	27	6	1	1	42	16	58	**28**	26
Forceps	0	1	0	2	12	4	74	4	0	0	86	11	97	**11**	14
Spontaneous	1	23	5	15	34	16	124	11	0	4	164	69	233	**30**	27.4
Total	**1**	**32**	**13**	**25**	**63**	**28**	**262**	**23**	**1**	**5**	**340**	**113**	**113**		

TABLE VII. EFFECT OF SEDATIVE AND ANESTHESIA ON INFANT MORTALITY

	UNDER 1,000 GM.		1,001-1,500 GM.		1,501-2,000 GM.		2,001-2,500 GM.		NOT STATED		TOTAL			PERCENTAGE	
	L	D	L	D	L	D	L	D	L	D	L	D	T	TRUE	EXPECTED
None	0	3	0	5	2	0	8	0	0	0	10	8	18	**44**	41
Local infiltration	0	1	3	0	6	3	8	0	0	0	17	4	21	**19**	30
Sedative only	0	3	0	1	2	1	12	0	0	0	14	5	19	**26**	28
Only anesthesia	1	20	9	13	34	15	128	13	0	3	172	64	236	**27**	27
Sedative and anesthesia	0	5	1	6	19	8	104	10	1	1	125	30	155	**19**	18
Not stated	0	0	0	0	0	1	2	0	0	1	2	2	4	**50**	42
Total	**1**	**32**	**13**	**25**	**63**	**28**	**262**	**23**	**1**	**5**	**340**	**113**	**453**	**25**	**25**
Per cent mortality	**97**		**65**		**31**		**8**		**83**						

TABLE VIII. EFFECT OF MATERNAL MORBIDITY ON INFANT MORTALITY

	UNDER 1,000 GM.		1,001-1,500 GM.		1,501-2,000 GM.		2,001-2,500 GM.		NOT STATED		TOTAL			PERCENTAGE	
	L	D	L	D	L	D	L	D	L	D	L	D	T	TRUE	EXPECTED
No pathology	0	15	5	10	42	7	178	20	1	4	226	56	282	**19.8**	20.3
Toxemia	1	2	5	3	10	8	34	1	0	0	50	14	64	**21.8**	25.7
Premature rupture of bag of waters	0	4	1	7	7	7	32	0	0	0	40	18	58	**31.0**	27.5
Abruptio placentae	0	1	0	0	0	0	4	1	0	0	4	2	6	**33.0**	22.9
Other pathology	0	2	0	3	2	2	10	0	0	0	12	7	19	**36.8**	36.0
Placenta previa	0	4	1	0	2	4	3	0	0	1	6	9	15	**60.0**	49.2
Hydramnion	0	4	1	2	0	0	1	1	0	0	2	7	9	**77.7**	66.5
Total	**1**	**32**	**13**	**25**	**63**	**28**	**262**	**23**	**1**	**5**	**340**	**113**	**453**		

per cent. This undoubtedly is an unfair figure because the number of cases was so small in that group. Although we have used sedatives and anesthesia to this extent in all groups, it does not appear from these figures that they have a notably harmful effect (see Table VII).

EFFECT OF MATERNAL MORBIDITY ON INFANT MORTALITY

In the same manner, eliminating the weight factor, a study was made of the true and expected mortality in relation to various pathologic conditions present in the mother. In 282, or 63 per cent, no pathologic condition was recorded. As one would expect, the mortality rate was lowest in this group. According to our figures, toxemia in the mother had no effect on infant mortality, as a matter of fact the rate was lower than the average and lower than the expected mortality. Premature rupture of the bag of waters showed an increase in infant mortality. While this condition is not strictly speaking maternal morbidity, we have included it here. As one would expect, the rates for abruptio placentae and placenta previa were high. Hydramnion showed the highest rate, 77.7 per cent for true and 66.5 per cent for expected mortality. Nineteen other cases were grouped under the heading of "other pathology;" these were only 4.1 per cent of the entire group, and we did not wish to divide them any further. The diseases included were: pyelitis, cardiac decompensation, carcinoma of the bowel and stomach, hyperthyroidism, pulmonary tuberculosis, and trauma from a fall. These conditions were all severe enough to have had directly or indirectly considerable influence on the infant mortality rate. This was quite high, the true rate being 36.8 per cent.

THE AGE AT DEATH OF THE 113 INFANTS WHO DIED

Table IX shows that 72 per cent of the infants who died, lived less than twelve hours. However, it must be stated that every infant who breathed at all, or whose heart was beating at birth has been included in this number. Many of them lived but a few minutes. It is obvious that this most critical time in a premature infant's life should receive the greatest study from the standpoint of aftercare. A discussion of the effect of infant care on mortality is not within the scope of this report.

TABLE IX. THE AGE AT DEATH OF 113 INFANTS

FIRST 12 HR.		12-24 HR.		24-48 HR.		3RD-10TH DAY		OVER 10 DAYS	
NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
82	**72**	12	**11**	7	**6**	6	**5**	6	**5**

Ninety-four per cent of the babies in this report who died were studied at autopsy. Too often the findings were inadequate to explain the specific cause of death. This is shown in Table X where it is seen that 63.7 per cent were reported as having died of prematurity or "congenital weakness." Actually this is not an anatomic cause of death but a physiologic state. In another 4.4 per cent, atelectasis was given as a cause of death, which likewise, to a great extent, is

TABLE X. CAUSE OF INFANT MORTALITY

CAUSES OF DEATH	UNDER 24 HOURS	2 TO 7 DAYS	8 TO 14 DAYS	OVER 14 DAYS	TOTAL	PER CENT
"Congenital weakness"	65	5	2	0	**72**	63.7
Asphyxia	14	0	0	0	**14**	12.3
Cerebral hemorrhage	8	6	0	0	**14**	12.3
Atelectasis	4	1	0	0	**5**	4.4
Malformation	2	0	2	0	**4**	3.6
Pneumonia	1	1	0	1	**3**	2.7
Acute enteritis	0	0	0	1	**1**	.9
Total	**94**	**13**	**4**	**2**	113	**99.9**
Per cent	**83.2**	**11.5**	**3.5**	**1.8**		

a physiologic state. In only 32 per cent could an anatomic cause of death be found; asphyxia and cerebral hemorrhage each 12.3 per cent; malformation 3.6 per cent; pneumonia 2.7 per cent; and acute enteritis 0.9 per cent. Only such cases, in which definite obstruction was found, were considered as having died of asphyxia.

CONCLUSIONS

1. The mortality for infants weighing less than 2,500 Gm. increases as the weight decreases.
2. The mortality rate increases as the intrauterine age at birth decreases.
3. The mortality curves for weight and intrauterine age are very nearly parallel.
4. Of all the criteria for determining prematurity, weight was the most reliable single factor.
5. The infant mortality rate was essentially the same for primiparas as for multiparas.
6. The number of female infants definitely exceeded the number of males, which is contrary to the ratio found for all infants at birth.
7. The death rate for male infants was practically 50 per cent greater than for females.
8. The length of labor apparently had very little effect on infant mortality.
9. The type of delivery seemed to have no pronounced effect on mortality.
10. The use of sedatives and anesthesia did not show an adverse effect on mortality.
11. Morbidity was found in 37 per cent of the mothers and had a definite effect on the infant mortality; most pronounced in accidents of labor and hydramnion, and least in toxemia.
12. The first twelve hours was the most critical time in these infants' lives and from the standpoint of infant care is the period that should receive thorough study.
13. In only 32 per cent of the infants who died could an anatomic diagnosis be established. Congenital weakness and atelectasis are not anatomic causes of death.

DISCUSSION

DR. EDWARD L. CORNELL.—I had been very enthusiastic about the care of small premature babies until a certain case which occurred in my private practice. I had thought I was very smart in keeping alive small premature twins only to find that they were idiots. They are still alive after two years. I think we should make every effort to keep alive babies that weigh 2,000 Gm., but where they are under 1,500 Gm., I have my doubts as to whether a large percentage will turn out to be perfect babies.

DR. HENRY J. ZETTELMAN.—By cutting the cord early or late, one may somewhat influence the blood picture in the newborn. In the past we have been taught to allow the baby to remain attached to the mother until the cord stops pulsating. That is not always feasible because the cord will pulsate for forty-five minutes. In several cases it has been possible to show that by cutting the cord immediately after the baby is born, the hemoglobin will be only 13 to 15 Gm., but if you allow the cord to remain uncut you can produce a hemoglobin of 22 to 25 Gm., and the red count will go up to 6,500,000. Is it not possible that in an effort to get these premature babies into a warm incubator, we cut the cord too early and prevent valuable blood coming to the baby?

DR. FREDERICK H. FALLS.—It is easy for the obstetrician to transfer his responsibility to the pediatrician. There is too often a tendency for the obstetrician to wash his hands of the care of the baby after its immediate birth.

Most people who have been entrusted with the conservation of life of these prematures have recognized that the preservation of body heat is a very important point. To that end, for a good many years, we have used a foot bath on the delivery room table. As soon as the baby comes out of the liquor amnii we put it in the warm water even before we cut the cord. We keep the water warm by adding hot water while we are sucking the mucus out of the pharynx and waiting for or establishing respiration. Then we remove the baby from the warm bath direct to warm blankets and then to the incubator.

We feel also that the most important thing in the management of premature babies is to prevent prematurity. The cause of prematurity is undue uterine irritability. The best way we have of preventing undue uterine irritability is to use a sedative to stop uterine contraction. The best sedative we have for this purpose is the corpus luteum extract, progesterone.

In cases of premature rupture of the membranes, placenta previa and premature detachment of the placenta in which it is only partially detached, a live baby may die if expelled, because of its prematurity. If you give a progestin preparation in sufficient amount so that it will stop uterine contractions, it will stop bleeding from the placenta previa and premature separation of the placenta. We have been able to control such bleeding for over three months, and we have been able to prevent abortion following rupture of the membranes for six weeks.

DR. DAVID S. HILLIS.—The proper management of a baby, born prematurely or in poor condition from any cause, should begin immediately after birth and this is part of the responsibility of the obstetrician. Every delivery room should have available an oxygen chamber automatically warmed and humidified which contains a concentration of oxygen of 50 per cent or more. Experience with this sort of device has given me a strong conviction that it is a valuable and necessary part of modern obstetric equipment. When the baby has gained strength after a few hours in such a chamber, it may then be transported to the premature nursery which will be so equipped that similar treatment may be continued as long as needed.

DR. LUSSKY (closing).—Reducing the premature infant mortality rate is a task which can be accomplished only by the joint efforts of the obstetrician and pediatrician. The pediatrician is primarily concerned with devising better methods and means for saving the infant after it is born. The obstetrician is primarily concerned with the problem of delaying birth as long as possible, or at least, as long as it is in the best interests of either the mother or infant.

The report shows that 83 per cent of the deaths occurred during the first twenty-four hours and that autopsy demonstrated an anatomic cause for death in only 32 per cent of the cases. In 64 per cent of the cases, the cause of death had to be ascribed to prematurity or congenital weakness. These probably were immature babies who simply cannot cope with external conditions no matter what we do or how hard we try. This group of infants would be greatly benefited if their intrauterine existence could be lengthened. But since at present this seems to be an impossibility, we must do the best we can with infant care and treatment.

No mention is made in this report on the influence of treatment in reducing the mortality. It is almost impossible to evaluate the effect of treatment, on account of the great number of unknown variables. Treatment is largely symptomatic. The physiologic condition of the infant, the pathologic condition in the infant, the effect of the length of labor, anesthesia, and pathologic conditions of the mother, etc., upon the individual infant are quantities which we are unable to determine accurately in our present state of knowledge.

The discussions have brought out several interesting points in regard to treatment. Delay in cutting the cord and stripping undoubtedly add to the infant's blood supply. Applying heat and giving oxygen are mainly symptomatic treatment, since most of these infants that die, succumb in the first twenty-four hours, before it is possible to make any accurate diagnosis. We have not as yet found means of supplying the premature infant with surroundings comparable to those in utero.

EXPERIENCES WITH A PLACENTAL BLOOD BANK*

W. Meredith Heyl, M.D., Philadelphia, Pa.
(From the Kensington Hospital for Women)

THE development of the use of stored blood which has become both practical and popular in the past few years has stimulated a search for new sources of this valuable material and better means of preserving it. The most common source of stored blood is from volunteer donors from whom the blood is taken as in indirect transfusion and stored for future use. The Blood Bank at the Philadelphia General Hospital is illustrative of this method. Then there is that group of patients including cardiac decompensations, polycythemia, etc., where venesection is indicated. Now, instead of being discarded, this blood is collected under sterile precautions, citrated, and stored for use in transfusion. Russian authors have proposed and report success with the collection and preservation of cadaver blood, taken from cases of accidental death or similar conditions where no pathology is present. They also were apparently the first to suggest the use of placental blood for transfusion. Since then there have come favorable reports of its use from England, Canada, Palestine, and the United States, the only question being the preservative to be used. The Placental Blood Bank at the Kensington Hospital for Women was set up in January, 1938, and has been in operation since then.

PLACENTAL BLOOD

Placental, or fetal, blood differs from adult blood in several ways. The hemoglobin and morphologic elements are increased. Hemoglobin,[1] 120 per cent (16 Gm. equals 100 per cent), red cells 5,500,000, white cells 20,000, of which 60 per cent are polymorphonuclears, 30 per cent lymphocytes, and 10 per cent monocytes. The quantity obtainable for collection varies widely from 30 to 200 c.c., but our average was about 75 c.c. Other writers report averages of 47 c.c.,[2] 55 c.c.,[3] 80 c.c.,[4] 105 c.c.,[5] and 125 c.c.[6] The blood is said to have[7] considerable bilirubin content, high sugar content, low cholesterol and alkali reserve, increased potassium and calcium, lower albumin content. It is said to contain estrogen, gonadotropic substance and an epinephrine-like substance. It is distinguished by its rapid coagulability. The blood may contain anesthetic or analgesic drugs used during labor, and recipients have been reported[5] to have complained of an ether taste after receiving a placental blood transfusion. We have had no such incidents. A report from Palestine[3] says that the blood is safe against malaria, as the organism does not pass the placenta, and in preserved blood the plasmodium quickly dies. The blood has a definite blood group or type and the fetal blood does not as one Russian writer[7] states, "always correspond to that of the mother's blood."

The inheritance of blood groups follows a Mendelian ratio of dominent A and B and recessive a and b.[8]

Type I—A and B
Type II—A and b
Type III—a and B
Type IV—a and b

*Read at a meeting of the Obstetrical Society of Philadelphia, October 5, 1939.

Corpuscles may contain one or both of two substances called A or B. Serum may similarly contain one or both of two agglutinating substances, a and b, acting on cells containing A and B, respectively. A and B therefore, can never be found in the blood of a child unless they are present in that of the father or mother. In our series, 45 per cent of fetal bloods were of different type than the mother's blood.

Fetal blood has the advantage of being free of allergens so that food and other extraneous allergic reactions are eliminated. A Wassermann reaction is not done on the cord blood because the mothers are tested routinely in the clinic, and the maternal Wassermann is said to be more reliable than the cord Wassermann.

PRESERVATIVE AND FLASKS

The preservative used in this series is that proposed by the Moscow Institute of Hematology and recommended by Goodall and his co-workers in their report. It consists of: Sodium chloride, 7.0; sodium citrate, 5.0; potassium chloride, 0.2; magnesium sulfate, 0.004; and bi-distilled water, q.s. 1000.

This solution is prepared in ampoules ready for use, but the price was prohibitive so, for a small sum, the above chemically pure drugs were bought in quantities and the hospital pharmacist dissolves the above formula in three ounces of distilled water, and these three-ounce bottles are kept on hand for use in filling the flasks. We use a 250 c.c., widemouth, Erlenmeyer flask which we have graduated at 100, 150, and 200 c.c. by scratching with a diamond pencil. A cotton plug covered with gauze is fitted in the mouth of the flask, and this is covered with a large flat piece of cotton covered with gauge, the ends of which are tied around the neck of the flask. As the plugs and covers usually are soiled with blood new ones are made each time the flasks are used again. A three-ounce bottle of preservative is emptied into a liter graduate and diluted to 1000 c.c. with triple distilled water. This is filtered through fine paper and 100 c.c. placed in each flask which has been thoroughly cleaned and rinsed with distilled water. The stoppers and top coverings are fastened in place and the flasks are autoclaved at 260° and 20 pounds pressure for twenty minutes. They are then stored in a convenient shelf in the delivery room. About 2 c.c. of the preservative are placed in each of an equal number of small test tubes which have rubber stoppers and are not autoclaved. These tubes are stored with the flasks and at the time of collection are attached to the flask and used for typing and cross agglutination.

Approximately equal parts of blood and preservative are used, and as our average yield is 75 c.c., we place 100 c.c. of the preservative in the flask as this will take care of the average collection. The flasks being calibrated at 200 c.c. we take no more than that amount in cases of heavy yield.

Two English writers[2] criticize this preservative saying that there is clotting and hemolysis due to insufficient citrate and hypotonicity. They recommend 0.3 Gm. of sodium citrate in 10 c.c. of distilled water. Another group[4] recommend 1 Gm. of sodium citrate in 80 c.c. of twice-distilled water but say that citrate-saline solutions are best. A Boston group[5] uses 15 c.c. of 2.5 per cent sodium citrate. In Palestine[3] a 3.8 per cent sodium citrate solution is used. In comparing the preservative we use with sodium citrate in saline, we found that 0.4 per cent, 0.5 per cent, and 0.6 per cent sodium citrate in saline preserved the blood in a similar state to that of our preservative. The gross hemolysis, shape of the red blood cells, hemoglobin, red count, white count, and differential behave similarly during the storage. In 0.1 per cent sodium citrate there was marked hemolysis, destruction of the red cells and clotting; 0.2 per cent and 0.3 per cent were slightly better but still presented clotting and hemolysis. In a personal communication from Dr. DeGowin of the University Hospitals of the State University of Iowa, he states that a mixture of dextrose and citrate will keep blood satisfactorily for one month, at the end of which time the hemolysis is about $\frac{1}{25}$ to $\frac{1}{50}$ as much as in citrated blood or in citrate plus saline. His work has been done almost wholly with adult blood, but he thinks it applicable to placental blood. This mixture of dextrose and citrate will probably be investigated with placental blood at the Kensington Hospital.

TECHNIQUE OF COLLECTION

At the completion of the second stage of labor, the child is placed on the mother's abdomen. The cord is immediately tied with tape and about 15 cm. of the cord distal to the tie is cleansed with a piece of gauze saturated with 65 per cent alcohol. The cord is grasped in this sterilized area with the gauze, pressure is exerted, and the cord cut with sterile scissors. A nurse, not scrubbed, removes the top covering of the flask, keeping the cover free of contamination, and holds the flask for collection. The operator removes the sterile plug and holds the end of the cord over the flask but not touching it and releases pressure on the cord allowing the blood to flow into the flask. By allowing slack in the cord and having the gauze well wrapped around it, there is prevented any contamination by amniotic fluid or other materials running down the cord. As the flow decreases the cord may be milked with care and more blood obtained. When the flow stops the sterile plug is reinserted in the flask by the operator and the uncontaminated tap gauze cover replaced by the nurse, who then holds an unsterile test tube for collection of a few drops of blood in the same manner. The cord is then clamped and attention paid to the third stage of labor. The small tube is attached to the flask with adhesive on which is written the mother's name, the date and later the type of placental blood.

There are certain contraindications to the collection of placental blood for storage. Any condition of the child or mother requiring the immediate attention of the operator would, of course, cause the procedure to be abandoned. Known transmissible diseases of either mother or child, as syphilis or tuberculosis, contraindicate collection of placental blood. Blood is not collected in cases in which the membranes have been ruptured forty-eight hours before delivery or where there is unusual soiling of the vagina as in extensive operative delivery. Eclampsia or toxemia is not, in itself, a contraindication. Premature infants have cords with so little blood that its collection is not warranted.

STORAGE

After collection the flasks are placed in a refrigerator with a temperature of 34° to 38° F. Temporary changes in temperature do not affect the character of the blood so that the refrigerator may be defrosted without moving the blood. It is said that[6] the blood settles into three layers. The top is a supernatant fluid which is clear at first but becomes colored as hemolysis progresses; the middle layer is a thick buffy coat and the bottom layer is composed of red blood cells. There are progressive and definite changes which occur in the cellular elements of the blood during storage. There is a progressive hemolysis which is evident in the coloring of the supernatant fluid and in the changes in blood counts. This hemolysis is hastened by shaking or unnecessary movement of the blood. Even in considerable degree the hemolysis does not interfere with a satisfactory transfusion. In our series the following studies were done at the time of collection and at weekly intervals for four weeks: Hemoglobin determination by the Sahli technique, red and white cell counts with differential and fragility tests. The hemoglobin remained about the same, being 42 per cent at time of collection and 38 per cent four weeks later. The red cells dropped progressively, being 1,620,000 at time of collection; 1,500,000 the first week, 1,170,000 the second week, 800,000 the third week, and 590,000 the fourth week. The white cells showed the greatest change, there being a complete disappearance of the granular series in the four weeks.

	WHITE BLOOD COUNT	POLYMORPHONUCLEARS	LYMPHOCYTES
At time of collection	2,940	68%	32%
First week	1,020	22	78
Second week	680	6	94
Third week	630	3	97
Fourth week	450	0	100

There was progressive increase in the fragility of the red cells. At time of collection the range was 0.42 to 0.28, in the first week 0.48 to 0.32, and by the second week it had reached 0.50.

When the bank was started and the studies were made on the blood, before it was used for transfusion, all of the flasks were cultured but no growth was found. Now about every tenth flask is cultured then discarded, and to date no growth has been obtained. Some writers,[2] using a more complicated technique of collection, have reported positive cultures in 22 per cent of the flasks, but this is the only paper reporting contamination, all others reporting negative cultures, as in our series.

USE IN TRANSFUSION

Sufficient flasks of all types are kept in readiness for immediate use. Prenatal patients are typed in the Clinic and in case a transfusion is necessary reference to their chart will give information as to their type, so that flasks of similar type blood may be immediately crossagglutinated with the recipient. We keep more Type IV flasks than any other type for, it being the universal donor, we use it in all types of recipients and prefer it to the same type in Type II recipients. The satisfactorily crossagglutinated flasks are then warmed to body temperature in a water bath, although this is not necessary, and given with normal saline. The blood is poured through several layers of sterile gauze into the burette, for occasionally there are soft clots in the bottom of the flask. The gauze removes them satisfactorily, and we have seen no disturbance from their presence in the blood. Several flasks of the same or different type may be used in the same transfusion if each is cross-agglutinated with the recipient.

RESULTS

Between January, 1938 and July, 1939, there were 32 transfusions given to 27 patients. The number of flasks used varied from one to four with an average of 2.4 flasks with each transfusion. The average amount of blood given in each transfusion was 275 c.c., the smallest was 75 c.c. and the largest 500 c.c. In 28 of the 32 transfusions, the donor and recipient were the same type. In 3 cases Type IV blood was given to Type II recipients. In one case mixed blood was given: 3 flasks of Type IV and one flask of Type I to a Type I recipient. The age of the blood when used varied from five days to six weeks, with an average age of 2.6 weeks. The effect of the transfusion seemed equally good regardless of the age of the blood. The indications can be grouped as follows:

1. Acute hemorrhage, as post-partum hemorrhage, hemorrhage due to placenta previa or abortion, 9 cases or 28 per cent.
2. Infection, including puerperal sepsis, pyelitis, peritonitis, infected abortions, 10 cases or 32 per cent.
3. Postoperative shock after difficult operations, or more than usual blood loss and who present a rapid, weak pulse on return to bed, 5 cases or 15 per cent.
4. Secondary anemias due to bleeding fibroids, abortions or malignancy, 8 cases or 24 per cent.

There were three questionable reactions, giving a gross incidence of 9.3 per cent.

1. One patient was anemic and in shock. She had had a hysterectomy, and after a transfusion she had a slight convulsive seizure of tonic and clonic type, lasting about ten minutes. Another patient the same day had a less marked but similar seizure following intravenous infusion of saline, so they may have been due to the flasks, tubing, or saline.
2. Another patient had a chill and temperature of 105° F. following transfusion. She had an infection after an incomplete abortion, with a temperature elevation before transfusion.
3. The third was a case of sepsis. The patient had chills and fever before transfusion and a chill and temperature of 103.6° F. after transfusion.

DISCUSSION

In presenting this technique for the preservation of placental blood and its use in transfusion, it is not suggested that this medium is superior to adult blood. In cases of elective transfusion, it is believed that adult blood is probably better and in such cases we use adult blood,

as 61 indirect transfusions of adult blood, as compared with 32 transfusions of placental blood, were given in the same period of time. However, in cases of emergency where blood is needed immediately, or, when in elective transfusion there is difficulty in finding a suitable donor, we feel that placental blood fulfills the requirements satisfactorily; especially when we have such an abundance of the medium which is so easily collected and preserved.

REFERENCES

(1) *Holt and McIntosh:* Diseases of Infancy and Childhood, ed. 10, New York, 1933, D. Appleton-Century Co. (2) *Hawkins, Brewer:* Lancet, p. 132, 1939. (3) *Halbrecht:* Lancet **1:** 202, 1939. (4) *Page, Seager, and Ward:* Lancet **1:** 200, 1939. (5) *Grodberg and Carey:* New England J. Med. **219:** 471, 1938. (6) *Goodall, Anderson, Altimas, and MacPhail:* Surg. Gynec. Obst. **66:** 176, 1938. (7) *Stavskaya:* Novy. khir. arkhiv. **37:** 72, 1936. (8) *Wright:* Physiology, ed. 4, 1932, Oxford Medical Publications.

438 East Durham Street

DISCUSSION

DR. EDWARD SCHUMANN.—In this technique, the promised transfusion can be done in twenty minutes and then, at leisure, the donors obtained for the much more valuable transfusion of adult blood. We have found it is a method which gives us great confidence and no member of the Staff would consent to abandoning the placental blood bank.

DR. CARL HENRY DAVIS.—It might be interesting in discussion to describe briefly the original blood bank in Moscow. In 1935 I spent a day with Judin, who developed the use of cadaver blood for transfusion. He citrated the blood in the first 300 collections of blood from dead people, but later discovered that this was not necessary. Since learning this, they have drawn the blood directly into sterile flasks and the flasks are placed in an ice box for two or three days before examination. After drawing the blood from the body, there is a very thorough autopsy. If there is evidence of disease, the blood is destroyed; if the body is healthy and the blood does not coagulate after being placed in the ice box, it is checked for syphilis, and a culture is made. At the end of a week, if all examinations indicate it is free from contamination, it is grouped. No blood is used in less than eight days from the time it is drawn from the cadaver.

We witnessed the process of drawing the blood. In a city like Moscow, they have a great many sudden deaths where the individual has not been greatly traumatized. Of course, a crushing injury rules out the possibility of the blood being used. If one dies of a sudden heart attack, etc., without definite disease, the blood should be suitable for transfusion. At any time within the first two hours after the death, the body is placed upon a table similar to that used for tonsillectomies, so that it is possible practically to stand the corpse on his head. With surgical precautions such as in an operating room, cannulas are placed in the veins on either side of the neck and the blood is drained through sterile tubes into flasks. With the feet up in the air the blood very rapidly fills the flasks. In that hospital, Dr. Judin said, the blood bank meant the saving of many lives.

Conserving blood from the placental circulation as described, seems like an excellent way to secure blood for a blood bank, and the reports thus far are favorable. Unfortunately, in the one patient where I used infants' blood, there was a rather severe reaction, but this probably resulted from some slip in technique.

INTERMENSTRUAL PAIN—A SURGICAL CONDITION*

EDWARD FRANCIS MCLAUGHLIN, M.D., PHILADELPHIA, PA.

IN SOME women there occurs discomfort, sometimes true pain, midway between menstrual periods or in the latter half of the menstrual cycle. This is considered a normal occurrence by some observers, especially in its milder forms. However, I regard it as abnormal and believe it is due to the rupture of small simple ovarian cysts or hemorrhage into them. When this pain grows severe enough for the sufferer to consult a doctor, it becomes a surgical problem, because it calls for differentiation from other conditions giving similar signs and symptoms which require immediate or elective operation.

Cases of intermenstrual pain are encountered most often by the general surgeons and are studied and reported almost exclusively by gynecologists. Wharton and Henriksen[1] among others speak of its frequency, yet the number of cases recorded in the literature is comparatively small.

First to describe intermenstrual pain in English was Sir W. O. Priestley before the Royal College of Physicians in London. He[2] published his observations in the *British Medical Journal* in 1872 and accurately described the clinical aspects of the midcycle type of pain and speculated with remarkable exactness that its cause lay in some disturbance of the process of ovulation which he placed ten to fourteen days before an oncoming period. He mentions work done by Bischoff in Germany and Poucet and Coste in France. Fehling[3] in 1881 advanced the theory of uterine contractions as a cause. H. Wilson[4] in 1905 first described hemorrhage from a ruptured Graafian follicle, noted at operation. Novak[5] in 1914 and in 1917[6] also added to the literature on the subject, especially on ovarian hemorrhage and stated "hematomas of the ovary are very common and are almost always caused by hemorrhage into the lumen of an atretic follicle or corpus luteum," a fact which seems to have been lost sight of or disregarded. In 1924 Phaneuf[7] brought out the difference between follicle and corpus luteum cysts. Pratt[8] in 1934 ascribed the "mittelschmerz" to irritating fluid from ruptured follicles, follicle cysts, or corpus luteum cysts. Hoyt and Meigs[9] in 1936 were the first to describe ruptured follicle and corpus luteum cysts as a surgical entity to be differentiated from acute appendicitis or ruptured ectopic pregnancy. They reported 58 cases and concluded that "discomfort in any woman in the supposed time of ovulation to the oncoming menses may be due to rupture or bleeding."

Also in this same year an article in the *J. A. M. A.* by Wharton and Henriksen[1] dealt with "Operative Observations in Periodic Intermenstrual Pain." Nine patients were operated upon at the time of pain; all had ruptured follicles. They proved this to occur simultaneously with ovulation in their cases. A distinction was made between acute and mild cases.

In 1937, Israel[10] pointed out that "the ruptured portion of the ovary is usually adherent to the posterior surface of the uterus and exhibits a hemorrhagic excrescence of varying size"—the first mention of the formation of adhesions.

De los Santos[11] reports a fatality from an overwhelming hemorrhage arising from a ruptured follicle cyst.

During this present year (1939) three excellent studies have been published on this subject, one by Pierra,[12] the second by Harris and Groper,[13] and the third by Weil.[14]

*Read at a meeting of the Obstetrical Society of Philadelphia, October 5, 1939.

PATHOLOGY

The occurrence of follicle and corpus luteum cysts, the simple cysts of the ovary, is well known, and their structures has frequently been described. Why they occur is not clearly understood, though several explanations have been advanced.

Such cysts may rupture and discharge their contents into the free peritoneal cavity with or without hemorrhage; or bleeding may occur within the cyst itself.

Underlying the symptom of intermenstrual pain is either first, the acute hyperemic reaction of the peritoneum to the escaped fluid (Israel[10]) or second, the distention of the cyst itself with blood. Of this latter condition, Hertzler[15] says, "Every possible degree of hemorrhage is observed. Small follicles partly or completely filled with blood are common. Not infrequently, cysts of the size of a walnut occupying the entire ovary, are filled with recently clotted blood."

PRESENT STUDY

Fifty-seven case histories have been analyzed. Five of the patients were nonhospitalized; one was in the Chestnut Hill Hospital, 12 in the Hospital of the University of Pennsylvania, and 39 in the Germantown Hospital. Both private and ward cases are included. They were cared for by different physicians. We, therefore, believe this study represents a fair cross section of the subject.

The statistical summary of our findings brings out several interesting points. Of the 57 patients, 22 showed intracystic hemorrhage, 23 ruptured cysts, and there were 12 who did not come to operation. The average age was 25.8 years. Of the patients 96.5 per cent were white, a striking predominance. The onset of pain was at the time of ovulation, or shortly thereafter, occurring as an average 16.6 days after the beginning of the last period. The symptoms in the intracystic hemorrhage group occurred 19.7 days after and in the "rupture" group 16.1 days after. From this, one would expect the hemorrhagic cysts to be of corpus luteum origin, and this was true. Of 22 such cases, 16 were of corpus luteum origin, 4 were of undetermined origin, 1 was of follicle and corpus luteum origin, and but 1 was from a follicle. Where ruptured cysts were found (23 times), examination revealed 11 were from corpus luteum cysts and 10 from follicle cysts, 1 of unknown type, and 1 from a mixed follicle and corpus luteum cyst.

Previous symptoms had occurred in 28 cases. Regularity of these preceding attacks was noted infrequently. A history of menstrual irregularity was obtained in only 6 instances.

Table I clearly demonstrates the more frequent occurrence of right-sided pain, and if one compares it with Table II, which shows an even greater frequency of right-sided tenderness, he may feel a little more kindly toward the surgeon who mistakes this condition for appendicitis. This mistake occurred in about one-third of all the cases. Of the 45 patients who came to operation, the primary diagnosis was appendicitis in nearly half (44.4 per cent).

Nausea occurred in 42 per cent of the cases and vomiting in only 15.8 per cent. Both nausea and vomiting occurred more frequently in the "rupture" group (52 and 26 per cent) than in the "intracystic hemorrhage" group (36 and 9 per cent). Diaphragmatic irritation was noted six times, one patient having a diagnosis of gall bladder disease with medical drainage of that viscus. A bloody or brownish discharge followed the intermenstrual pain in eight instances.

The average figures for temperature, pulse, white blood cell count, and differential count are strikingly normal. Their exact distribution among the groups is expressed in Table III.

TABLE I. LOCATION AND TYPE OF ONSET OF PAIN

	GROUPS*			
	I	II	III	IV
Lower right quadrant	29	12	11	6
Lower left quadrant	11	3	6	2
Lower abdomen	6	4	1	1
Lower midabdomen	3	1	1	1
Unrecorded	8	2	4	2
Rapid onset	18	5	8	5
Slow onset	39	17	15	7

*In the tables, the whole group is designated Group I, cases of intracystic hemorrhage are designated Group II, those of cyst rupture into the peritoneal cavity, Group III, and the nonoperative cases, Group IV.

TABLE II. ABDOMINAL TENDERNESS

	GROUPS			
	I	II	III	IV
Right	40	14	16	10
Left	4	2	1	1
Both	7	2	5	0
None	4	2	1	1
Unknown	2	2	0	0

TABLE III. PREOPERATIVE FINDINGS

AVERAGE	GROUPS			
	I	II	III	IV
Temperature	98.73	98.9	98.6	99.4
Pulse	90.98	89.5	92.2	91.1
White blood count (in 50 cases)	10,435	9,295	10,766	13,016
Polymorphonuclears (in 39 cases)	72%	74.67%	74%	70.6%

TABLE IV. OPERATIVE FINDINGS AND PROCEDURES

	GROUPS		
	I	II	III
Operative Findings:			
Right ovary involved	29	12	17
Left ovary involved	16	10	6
Adhesions	7	3	4
Operative Procedure:			
Removal of cyst and closing defect	24	8	16
Salpingo-oophorectomy	15	10	5
Oophorectomy	6	4	2

It is of interest to compare these signs and symptoms of Groups II and III with the operative findings in the same groups, as exhibited in Table IV. Here the involvement, while definitely more on the right, especially in the ruptured cyst cases, is not so in as great a proportion as one would expect from the preponderance of right-sided symptoms and signs.

Unlisted in tabular form but of some importance is the fact that 28 of the patients were married and 29 were single. Besides appendicitis, ectopic pregnancy was the primary diagnosis in one case, pelvic inflammatory disease in two, functional bleeding in one, and gastroenteritis or rheumatic fever in one other. Of the patients coming to operation, a correct diagnosis was made preoperatively in 31.2

per cent, not attempted in 15.5 per cent, and incorrect in 53.3 per cent, a mediocre showing. Free fluid was found in but 16 of the 45 patients operated upon, being clear in 10 cases, bloody in 4, and chocolate colored in 2.

DIFFERENTIAL DIAGNOSIS

Cases with marked intraperitoneal hemorrhage simulating ruptured ectopic pregnancy need not be differentiated; the treatment will be the same. More of a problem is the differentiation between an unruptured or slowly rupturing ectopic and an intracystic hemorrhage. The Friedman test should be positive if rupture has not occurred, or has but recently occurred in the pregnancy. It will be negative with cysts.

Blood sedimentation will be more rapid and more pronounced in the rupturing tubal pregnancy than where the intracystic hemorrhage has occurred.

From pelvic inflammatory disease, temperature, pulse rate, sedimentation test, and smears would help make the distinction.

Ovarian cysts with twisted pedicles are usually large enough to be palpated, larger than the follicle or corpus luteum cysts.

From acute appendicitis some cases cannot be distinguished. However, if one has in mind the possibility of ruptured cyst or intracystic hemorrhage, he may not only save a patient from operation but himself from embarrassment. The temperature, pulse, and white count are much nearer normal in the ovarian condition. The cystic lesion is accompanied by less vomiting. There may be a history of former attacks occurring near the midcycle and perhaps accompanied by a brownish discharge. A point noticed by the author as well as others is that the pain frequently starts and stays in the lower right quadrant, whereas in appendicitis it is usually first general and later settles to its source. At times one may be able to palpate a swollen ovary through the vagina or rectum. When one encounters a pelvic appendicitis, however, it is almost impossible to make a differentiation. Temperature and pulse rate will be probably more elevated in the appendicitis, but they are weak supports on which to lean where the question is so fine.

It is with so-called "chronic appendicitis" that a better differential diagnosis could be made. One has a chance here to observe a patient more leisurely, and it will be surprising how many of the confirmatory symptoms of ovarian trouble will unfold themselves if they are but sought for. Regularity of attacks (perhaps not each successive month), occasional brownish or bloody discharge with one attack, a shifting to the left side now and then, and perhaps noting the presence of what Curtis terms "Phantom tumors"—cysts which can no longer be felt after spontaneous rupture. All these things and more will help bring about correct diagnosis.

The most inexcusable error is the failure to recognize ovarian disease when the abdomen has been opened. McBurney incisions and small right rectus openings up near the umbilicus make examination of the pelvis almost impossible. Another careless thing is the opening of the peritoneal cavity without first securing hemostasis and thus allowing

blood to trickle in. This mixing with the peritoneal fluid will effectively mask a serosanguineous fluid already present from a ruptured cyst, and take away the only stimulus to investigate the pelvis. Intracystic hemorrhage was taken for chronic or recurrent appendicitis in seven instances. This condition is infrequently accompanied by free fluid, so in order to find it the ovaries should be examined on every possible occasion. We believe the unrecognized presence of rupturing follicles or intracystic hemorrhages to be responsible for the continuation of symptoms in many cases of "chronic appendicitis."

COMMENT

The appearance of the pelvis of some of these patients at operation gives rise to a plausible speculation. There are often definite adhesions present between the site of the ovarian rupture and the posterior surface of the uterus or broad ligament. Some of these adhesions certainly do not absorb completely. May they not of themselves or by the congestion they may cause, give rise to that large group of so-called "chronic pelvic inflammatory disease" cases (never proved to be of gonorrheal origin) which are seen daily in every gynecologic dispensary? It is our belief that this is the case in many instances.

The principal lesson to be learned from this study is that rupturing follicles or corpora lutea and intracystic hemorrhage do occur and may simulate acute or chronic surgical conditions of the abdomen. This should be borne in mind in patients presenting intermenstrual pain. A correct diagnosis is often possible and if arrived at, nonoperative treatment is indicated. But then the possibility of future attacks must be kept in mind, because (again quoting Wharton and Henriksen[1]) "in these cases one is dealing not only with an isolated ruptured corpus luteum but with a recurring dysfunction of the ovary. The basic cause lies deeper and is as much a mystery today as it was to Poucet and Priestley."

SUMMARY AND CONCLUSIONS

1. Fifty-seven cases of ovarian dysfunction, giving rise to intermenstrual pain, are reported.

2. Twenty-three of these cases showed ruptured cysts, 10 follicle cysts, 11 corpus luteum cysts, 1 both types, 1 unreported.

3. Twenty-two cases showed intracystic hemorrhage, 16 hemorrhages into corpus luteum cysts, 4 into cysts of unreported type, 1 into a follicle cyst, and 1 into a follicle and corpus luteum cyst.

4. The present series is composed chiefly of white women of an average age of 25.8 years.

5. The right ovary is the one more often involved (64.5 per cent), though a larger group of patients have right-sided symptoms (70 per cent).

6. Accurate diagnosis was made twenty-four times or in 42.1 per cent of all patients and in 31 per cent of patients operated upon.

7. The most confusing condition was appendicitis. It was the primary diagnosis in 36.8 per cent of the patients and was mentioned in 59.6 per cent. Of the operated cases, 44.4 per cent were diagnosed primarily as appendicitis.

8. The usual operative procedure is removal of the cyst and oversewing of the raw area.

9. No fatalities are noted.

10. The known occurrence of intracystic hemorrhage is here studied clinically and differentiated from chronic appendicitis.

11. It is suggested that adhesions from cyst rupture may give rise to a nonspecific pelvic inflammatory disease.

12. The so-called "mittelschmerz" occurred with very little regularity in this series.

13. If one is alert to the possibility of the ruptured cysts or intracystic hemorrhage, diagnosis can be made oftener and nonoperative treatment pursued.

REFERENCES

(1) *Wharton, L. R., and Henriksen, E.:* J. A. M. A. **107:** 1425, 1936. (2) *Priestley, W. O.:* Brit. M. J. **2:** 431, 1872. (3) *Fehling, H.:* Arch. f. Gynäk. **17:** 338, 1881. (4) Quoted by Hoyt and Meigs.[9] (5) Quoted by Hoyt and Meigs.[9] (6) *Novak, E.:* J. A. M. A. **77:** 692, 1921. (7) Quoted by Hoyt and Meigs.[9] (8) *Pratt, J. P.:* Am. J. Obst. & Gynec. **27:** 816, 1939. (9) *Hoyt, W. F., and Meigs, J. V.:* Surg. Gynec. Obst. **62:** 114, 1936. (10) *Israel, S. L.:* Am. J. Obst. & Gynec. **33:** 30, 1937. (11) *de los Santos, E. V.:* J. Philippine Islands M. A. **18:** 17, 1938. (12) *Pierra, C.:* Rev. franç de gynéc. et d' obst. **34:** 65, 1939. (13) *Harris, F. I., and Groper, M. J.:* Surg. Gynec. Obst. **68:** 824, 1939. (14) *Weil, A. M.:* Am. J. Obst. & Gynec. **38:** 288, 1939. (15) *Hertzler, A. E.:* Surgical Pathology of the Female Generative Organs, Philadelphia, 1932, J. B. Lippincott Co., Chapt. IV.

DISCUSSION

DR. EDWARD SCHUMANN.—Mittelschmerz is a regularly recurring symptom. If the patient complains of such a symptom over a long period of time, this diagnosis may be considered and inflammatory lesions ruled out. Under such conditions I see no reason for operation.

If these 57 cases were unruptured Graafian follicles or instances of intrafollicular rupture, why should one do anything to the ovary. It certainly seems very radical to remove an ovary under such circumstances. If the hemorrhage is massive, it becomes necessary to operate for the hemorrhage and ligate the bleeding vessels. Ordinarily, however, if in error one opens the abdomen for intermenstrual pain one should immediately close it again.

DR. S. LEON ISRAEL.—I believe that the diagnosis of ovarian rupture with intraabdominal hemorrhage can be made preoperatively if the physician viewing an acute or subacute abdomen bears the subject in mind. At the Massachusetts General Hospital, in 58 cases, one-third were diagnosed correctly by exerting a conscious effort to think of the condition.

It is interesting to note there is occasionally even a postoperative error. The general surgeon approaches the abdomen with a diagnosis of subacute or subsiding appendicitis, employs a McBurney's incision and, finding a slightly bulging appendix, removes it. As he works, a trickle of blood may come up from the lower abdominal cavity, the pelvis is explored, and sometimes an ovarian rent is seen. The abdomen is closed, and the pathologic report is "subacute appendicitis." Such appendices often show serosal and subserosal inflammatory reaction, particularly if some free blood has been in the neighborhood for twenty-four hours.

It is interesting to speculate on the cause of bleeding from a ruptured corpus luteum and why it does not occur more frequently. The fact is that not all bleeding is attended by symptoms in our experience. I think it is impossible, at the present time, to state why certain corpora lutea rupture without bleeding, and why certain others rupture and bleed severely.

DR. MC LAUGHLIN (closing).—In reply to the questions of Dr. Schumann, I wish to say that I was reporting what was actually done in the way of operation and was not advocating these radical measures. In defense of opening the abdomen frequently I may say that these ovaries are frequently found to be still bleeding and something must be done, even though the hemorrhage is small.

TRANSPERITONEAL APPROACH IN THE MANAGEMENT OF INACCESSIBLE VESICOVAGINAL FISTULAS*

W. C. Danforth, M.D., Evanston, Ill.

(From the Department of Obstetrics and Gynecology of Northwestern University Medical School and of the Evanston Hospital)

THE management of vesicovaginal fistulas located at the vault of the vagina, particularly in women who have never borne children, may be a very difficult problem. In the past two years, in my own experience, there have been two cases in women over 50 years of age, both of whom were nulliparas in whom fistulas were found at the highest part of the vagina. Both of these followed complete hysterectomy. One of these was closed by the use of an electrocoagulating wire passed through the fistulous tract in order to destroy its lining. This was done by the urologist to whom she was referred. In the second case this procedure failed to close the opening and a further attack was necessary.

In 1910, and again in 1917, Ward described a method for the closure of inaccessible vesicovaginal fistulas in which he made use of a Schuchardt incision in order to obtain approach to the area in which the fistula lay. This was a useful contribution and in many cases would be of distinct service. Transvesical operation has been suggested and successful cases have been reported. Our experience is limited to one case in which we had a failure. Extraperitoneal approach has been used by some operators.

In the case I wish to discuss a transvesical attempt to close the opening had already been made elsewhere. This had apparently only controlled the leakage for a few days, urine escaping vaginally before the patient left the hospital. Considerable thought was given to the method of attack. The method of Ward was seriously thought of and only discarded because the vagina was so narrow that a small speculum was needed to expose the opening in the vaginal vault, the ordinary size used in the adult patient being too large. The vagina would barely admit two fingers. It appeared that, in order to expose the area of the fistula and to obtain space for adequate dissection and mobilization of the vaginal and vesical tissues, an extremely deep incision would be needed. It was therefore determined to enter the abdomen and to approach the fistula from above. The history follows:

A nulliparous woman, aged 54 years, was operated upon in China, for complete hysterectomy five months before admission. The indication for this is not clear. Vesicovaginal fistula followed this operation. Two months after the hysterectomy a transvesical attempt was made to close the fistula, but this was unsuccessful. When first seen she was passing practically all of her urine through the fistula, voluminous pads being required constantly. Examination showed a recent abdominal scar, well healed. Vagina was narrow and small, admitting only a small-sized speculum at the highest portion of the vault. A little to the right of the median line a vaginal opening to the bladder was seen, through which urine was escaping.

*Presented at a meeting of the Chicago Gynecological Society, October 20, 1939.

A probe would not pass into the fistula which, evidently, was tortuous. Cystoscopy by Dr. J. I. Farrell disclosed vesical end of fistula at the base of the bladder, to the right of the median line, surrounded by scar tissue which probably followed an attempt at repair.

One week later an attempt was made by Dr. Farrell to close the fistula by passing an electrocoagulating wire through the cystoscope into the fistulous tract, in order to destroy its epithelial lining. Relief for a few days followed this, probably by reason of the edema of the tissue surrounding the fistula, but leakage soon began again. Operation was then decided upon and was carried out as follows:

Median Laparotomy.—Separation of extensive adhesions. After slowly dissecting the bladder off the vaginal vault, the fistula was difficult to locate. The bladder

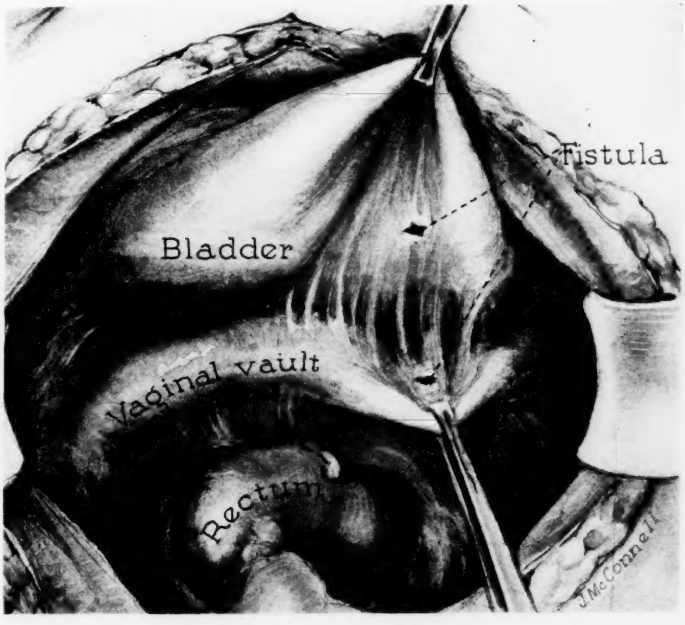

Fig. 1.

was then injected with methyl blue and after further dissection the blue escaped through the fistulous opening. The hole in the bladder and the hole in the vagina were separated and dissection around them was carried out until the bladder could be mobilized. With three interrupted sutures of fine catgut the hole in the bladder was closed and with the second row of sutures this first row was turned in. The vaginal opening was then closed. Omentum could not be brought down to the area of sutures, so a piece was detached and was sutured between the suture lines in the vagina and the bladder, in order to prevent their coming in contact. Penrose drain was carried down to the pelvis. Closure of the abdominal wall by layer sutures of catgut, four stay sutures of braided silk and running silk suture in the skin. One laparotomy pad was introduced but this was removed. A retention catheter was left in the bladder.

My preference, in operating upon fistulas between the vagina and the bladder, is to deal with them from below. In all clinics it has been found possible to manage the great majority by vaginal operation. It is because, in rare cases, especially in elderly nulliparous women, fistulas located at the highest point of the vaginal vault may be difficult to get at even by the method of Ward. I wish to direct attention to this method. In 1881, Trendelenburg suggested the possibility of operating upon inaccessible fistulas in this way, but was successful for the first time in 1888. Legueu, in 1914, described the method of transperitoneal operation for the closure

of vesicovaginal fistulas and reported 24 cases. The technique described by him was essentially that which was used by me although I had not seen his report at the time of the operation. He emphasized the importance of separating the suture lines in the bladder and in the vagina, because of the likelihood of a recurrence of the leakage if they are in contact. No method was used of securing their separation other than an attempt to so place the sutures that they would not be in contact. In 1937, Walters reported two cases in which transperitoneal repair was done. The technique in his patients did not vary materially from that described by Legueu, except that he suggested the use of a liberal amount of omental tissue which should be interposed between the two suture lines, in order to separate them effectively. He did not detach a piece of omental fat but drew the lower end of the omentum down and fastened it between the bladder and the vagina.

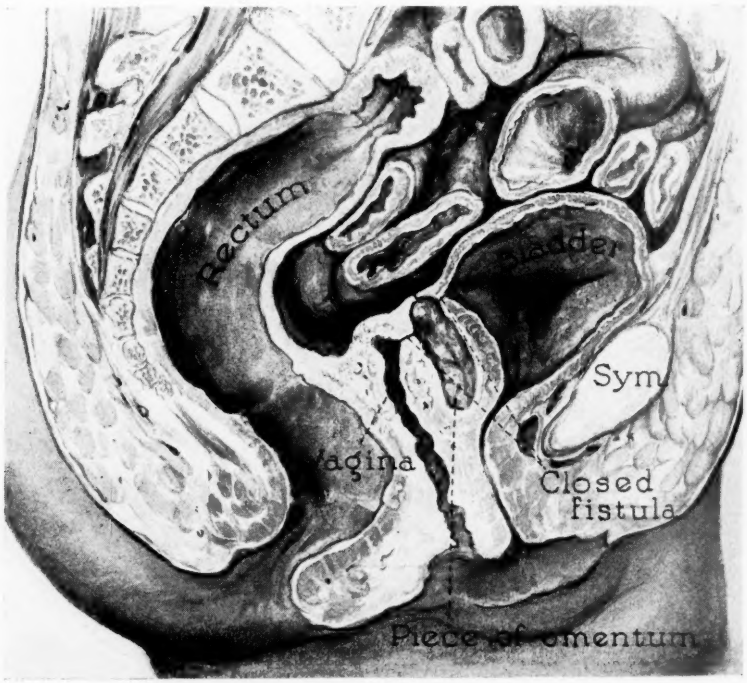

FIG. 2.

In the case which I describe, it was not possible to do this, as the omentum was not long enough to make it possible to draw its lower end into the operative field. Accordingly, a piece, roughly square and about 10 cm. on each side, was excised from the omentum and sutured between the two repaired structures with fine catgut.

In parous women, the vaginal relaxation which is usually present will allow access to the fistula, although the deep incision advocated by Ward may be needed. In exceptional cases, as the one here described, the transperitoneal approach may be useful. If I have occasion to make use of the operation again, I shall have a ureteral catheter passed through the fistulous tract before beginning the operation, in order to facilitate the finding of the fistulous tract.

This patient has remained completely dry since the operation. A Pezzer catheter was left in the bladder for fifteen days. For some time after operation she complained of frequent urination but at no time was there lack of control. This disappeared within two weeks and at present she has complete control of the bladder. She urinates usually once during the night but says that she had done that for years before the operation which was the cause of the fistula. I wish merely to draw attention to an operation which, in occasional cases, may provide

a means of meeting what may appear to be a very difficult technical problem. The use of the mass of omental fat in order to keep the suture lines in the bladder and the vagina apart I believe is an extremely valuable, if not indispensable, part of the procedure. The great importance of a complete separation of the two suture lines should be emphasized.

DISCUSSION

DR. JOSEPH L. BAER.—One can do no more than applaud the successful outcome of a difficult operation of this sort which relieves the patient of an intolerable disability. I have two questions in mind. Dr. Danforth intimated that if the omentum had reached the area in which he did the repair, he would have tacked it into that area. Since it did not, he resected a piece of omentum and interposed it between the vagina and the bladder. I wonder if he had this to do again would he not prefer to use a piece of detached omentum rather than anchor the omentum into the true pelvis and thereby set up a train of gastrointestinal symptoms.

Second, if I heard correctly, Dr. Danforth said he used a Pezzer catheter which was left in situ for fifteen days. Our experience is that the longer a catheter is left in situ the more certainly the patient gets some degree of cystitis. If that is true, then much earlier removal of the permanent catheter with catheterization at intervals sufficient to guard against over-distention would do away with the risk of causing a severe postoperative cystitis.

DR. CHANNING W. BARRETT.—It seems to me in the average case that the abdominal approach to a vesicovaginal fistula is impractical. There is only the occasional case in which the smallness of the vagina might make a vesicovaginal fistula difficult to reach.

The best way of closing that bladder is by suture of the bladder wall, and a piece of spongy omentum would be quite unnecessary.

DR. H. O. JONES.—One occasionally sees vesicovaginal fistulas that empty into the vagina many inches away from their origin. I have seen one case in which five different efforts to repair failed.

I would like to ask Dr. Danforth if all these patients are not better if they lie on the abdomen and face during the recovery period after operation.

DR. EUGENE A. EDWARDS.—Is it a wise procedure to transplant omentum into a potentially infected field? I once saw such a transplant become infected. It later came out of the abdominal incision.

DR. W. C. DANFORTH (closing).—In regard to Dr. Baer's question, I was influenced in my desire to use omentum without detaching it by a report by Waltman Walters of the Mayo Clinic. Since in this case it worked out successfully, I should do the same in another case.

As to the catheter, I left it in deliberately longer than we ordinarily do, because I wanted to protect the wound from any distention or pressure. We had to change the catheter a number of times. On one occasion it became quite full of incrustations. When this occurs, the catheter is of little value.

Dr. Barrett spoke about the abdominal route. We only chose this method after considering a closer means of approach. We do not ordinarily adopt this route. I should attack from below under ordinary circumstances. It was a difficult case, because it had been operated upon twice before.

I think in most cases it is wise to use the abdominal position for postoperative care which Dr. Jones spoke of. We employ it usually but in this one we sat the woman up on a back rest because of the abdominal wall which, at first, was drained.

FOCAL INFECTIONS IN PREGNANCY*

TOM D. PAUL, M.D., AND CHARLES EDWIN GALLOWAY, M.D., F.A.C.S.,
EVANSTON, ILL.

(From the Department of Obstetrics and Gynecology, Northwestern University and the Evanston Hospital)

WHEN in 1931, a paper on "Focal Infections in Pregnancy" was written by one of the authors (C. E. G.), it was suggested that, since prenatal care is a form of preventive medicine, one should be as thorough as possible in one's investigation of the pregnant woman. It was contended that the possible role of foci of infection, especially in the teeth and tonsils, was being overlooked. In 1929 one of us (C. E. G.) began to require full-mouth roentgen ray films for all those receiving prenatal care.

The paper[1] published in 1931 was based on 242 cases studied. Among these, 36 patients, or 15 per cent, were found with definite apical infections. Of these 36 patients, 25 had extractions with no resulting abortions. Twelve uneventful tonsillectomies were also reported. The following statement was made at that time, "It is very difficult to demonstrate any benefit from a preventative procedure such as the removal of various foci of infection, but since adopting the procedure of requiring full-mouth x-ray films and examination of the teeth and tonsils, I have had fewer cases of pyelitis, mastitis and toxemia."

In the present study we have attempted to determine whether such a procedure has proved successful in private practice. The paper is based on the study of 843 additional pregnancies occurring in 704 women. The cases previously reported are not included. The roentgen ray report accompanies each record of the 843 pregnancies. One hundred and twenty-five, or 14.8 per cent, disclose the presence of definite apical infection. This agrees closely with the 15 per cent incidence of infection noted in the earlier paper. A study of these 125 pregnancies, where apical infections could be demonstrated, shows that 85 patients had infected teeth extracted during pregnancy. The remaining 40 retained their infection. Twenty-seven additional extractions were done because of excessive decay.

In 36 cases, or 4.27 per cent, tonsillectomies were advised because of apparent foci of infection; 23 tonsillectomies were performed. Six hundred and thirty-two patients showed no apparent evidence of infection in either teeth or tonsils.

INCIDENCE OF PYELITIS

The literature on pyelitis of pregnancy gives widely diverent figures for the incidence of this complication of pregnancy. Douglass and Laughlin[2] state that pyelitis of pregnancy occurs in about 25 per cent of the cases. They quote Traut with an incidence of 2 per cent, Mussey with 20 per cent, Baird 42.5 per cent, and Emge 7 per cent. McLane[3] in a five-year study at the New York Hospital saw

*Presented at a meeting of the Chicago Gynecological Society, October 20, 1939.

168 cases of proved pyelitis in a total of 14,000, an incidence of 1.2 per cent. He said that many more cases were studied but were discarded because of insufficient evidence of pyelitis. Kretschmer makes the statement that many cases of pyelitis in pregnancy are overlooked because of the mildness of the symptoms and failure to study the urine carefully.

In this series of 843 pregnancies there were 30, or 3.50 per cent, with urinary tract infection, varying from a definitely infected urine to typical pyelitis with chills, fever, and pain sufficient to warrant bed rest. In the 632 pregnancies with no evidence of foci of infection, the incidence is 3.16 per cent. The 85 pregnancies in which infected teeth had been removed showed an incidence of 2.35 per cent. The 40 pregnancies in which infected teeth were not removed as advised showed an incidence of 17.5 per cent. As far as this small series is concerned, infected tonsils did not seem to be an important factor in the occurrence of pyelitis.

INCIDENCE OF HYPERTENSIVE TOXEMIA

Dieckmann and Brown[4] have given an incidence of 7.5 per cent in delivery of toxemic patients in their study of hypertension and pregnancy. In a more recent study of the toxemic patient[5] they have stated that the hospital incidence of non-convulsive toxemia of pregnancy in the United States varies from 0.2 per cent to 29 per cent, an average of 4 per cent. In this study, any patient having a blood pressure of 140 or more, with albumin in the urine, and edema was considered to have toxemia of pregnancy. We make no attempt to classify these cases other than to state that no cases of eclampsia occurred in the group.

In the 843 pregnancies there were 28, or 3.32 per cent, with varying degrees of toxemia. In the 632 patients with no evidence of foci, the incidence was exactly the same. In the 40 patients who had infected teeth remaining, the incidence was 5 per cent. In 13 patients with suspected infected tonsils still present, the incidence was 7.6 per cent. This group of patients is too small to enable us to draw any conclusions from the findings, but these figures would seem to indicate that foci of infection do play at least a small part in the production of toxemia of pregnancy.

INCIDENCE OF ABORTION

In a previous paper[6] we reported an incidence of abortion of 7.9 per cent among our private patients. By abortion we mean the loss of the pregnancy up to the twenty-eighth week. This paper considered all cases of abortion, and, since many of these were first seen at the time the bleeding started, there were no records to indicate the presence of foci of infection. Thus, many cases of abortion could not be used in this study and the incidence of abortion in this series of 843 pregnancies is only 5.6 per cent for the entire group and 4.43 per cent for the 632 patients, with no evidence of foci in the teeth or tonsils. The incidence of abortion in the 85 patients in whom infected teeth were removed was 4.7 per cent, and in the group of 40 patients where the infected teeth were not removed, it was 20 per cent, an increase almost five times as high. In only 3 patients was the extraction of the teeth considered a direct factor in causing the abortion, an incidence of 3.5 per cent. These cases will be given in detail later.

The 13 patients where the tonsils were considered infected gave an incidence of 15.4 per cent for abortion. Of the 23 tonsillectomies done, 3 patients had the pregnancy terminated by abortion, but careful study of these records seems to indicate that in only 1 patient was the operation a definite factor in producing the abortion. Allowing for this, we have an incidence of 4.3 per cent for abortion resulting from tonsillectomy. Details on these cases are given at the end of the paper.

DISCUSSION

We are convinced that foci of infection in the teeth and tonsils should be carefully searched out and removed as soon as found. Failure to remove these foci of infection seems to increase the incidence of abortion and perhaps is a factor tending to increase pyelitis. The incidence of abortion resulting from extraction of teeth or removal of tonsils is no

greater than that of apparently normal cases, and their removal should not be a deterring force. We stress the following in regard to the removal of teeth and tonsils in pregnant women:

1. Removal of all foci as early as possible.
2. Some patients gag when being x-rayed. If nausea is already present, a mild sedative is suggested or painting with a weak cocaine solution.
3. It is best not to extract at the time of a menstrual cycle.
4. The patient should remain at home for two or three days following an extraction.
5. Codeine is used for relief of pain rather than anacin or other compounds which contain quinine.
6. There should be no upper respiratory infection at the time.
7. Only local anesthesia should be used for extraction of teeth or tonsillectomy; the risk of general anesthesia is too great. The operator may be forced to hurry, and with tonsillectomy there is danger of lung abscess.
8. If the patient has a severe reaction, she must be put to bed, given a narcotic and proluton or lutein.
9. It is a good general rule to have x-rays made, if possible, by one who does nothing else. The average dentist makes poor pictures, and it costs the patient no more to have them made by a special laboratory. The dentist is usually glad to have a better set of x-rays than he himself can make. The obstetrician is seeking consultation and has a right to send the patient wherever he believes the best results are being obtained.
10. Extractions are better handled by an exodontist.
11. The patient should be told, not asked, to have the teeth or tonsils removed.

SUMMARY

1. This study of 843 pregnancies shows that 14.8 per cent of the patients had definitely infected teeth and about 4.27 per cent had tonsils which could be considered harboring foci of infection.

2. The incidence of pyelitis in the entire group was 3.56 per cent, whereas, the incidence was 17.5 per cent where infected teeth were allowed to remain during the pregnancy.

3. The incidence of hypertensive toxemia in the entire group was 3.32 per cent. In the patients with infected teeth it was 5 per cent. In patients with infected tonsils it was 7.6 per cent.

4. The incidence of abortion was 5.6 per cent for the 843 cases. In patients with infected teeth not removed, 20 per cent aborted. In those patients with infected tonsils, 15.4 per cent aborted.

5. The incidence of abortion which could be attributed to the removal of foci was 3.5 per cent for extraction of infected teeth and 4.3 per cent for removal of tonsils. These figures are lower than the incidence for the entire group.

CONCLUSIONS

Routine search for and elimination of foci of infection in the teeth and tonsils should be a regular part of prenatal care if patients are to receive the attention due them.

Failure to remove such foci leads to a greater incidence of pyelitis and abortion and a smaller but definite increase in toxemia.

Removal of these foci of infection during pregnancy does not increase the risk of abortion over that normally found.

PROTOCOLS

Abortion cases after tooth extraction:

CASE 73.—Mrs. H. L. H., aged 32 years, para ii, last menstrual period Feb. 28, 1930, was first seen on May 2, 1930. She had one infected tooth extracted at the end of May and a severe reaction followed. The patient was in hospital on June 5 and 6 with pelvic pain and spotting. On July 7 she was again hospitalized for spotting and pain. On July 21 she expelled a four-and-one-half-months' fetus and placenta.

CASE 87.—Mrs. M. M. Z., aged 29 years, para iii, last menstrual period Feb. 1, 1930, was seen on March 11 and then not until May 2, during which time she had a severe left antrum infection and chronic sore throat. On May 26 it was noted that the patient had had an infected upper left first molar extracted and a tonsillectomy was advised. Note June 24 reads, "Missed abortion 3 months." Pregnancy test on July 1, 1930 was negative. The uterus finally was evacuated Aug. 14, 1930.

CASE 680.—Mrs. J. R., aged 31 years, para i, last menstrual period May 5, 1936, was first seen June 20, and she had had six teeth extracted shortly before this, some of which were infected. On June 29, patient had bloody show and aborted July 6, 1936.

Abortion cases after tonsillectomy:

CASE 223.—Mrs. A. J. W., aged 29 years, para ii, last menstrual period March 17, 1934, was first seen April 24, and tonsillectomy was advised. Tonsillectomy was done on May 1, 1934, at St. Luke's Hospital. She was seen in the office May 15 and everything was apparently normal. On May 30 she reported spotting without pain. On June 1 profuse bleeding began; patient was sent to the hospital and dilatation and curettage were done.

CASE 278.—Mrs. G. W. P., aged 35 years, para iii, last menstrual period Feb. 15, 1931, was first seen May 26, and tonsillectomy was advised. She also had possible areas of infection at the apices of two teeth. On June 26 the tonsils were removed. She felt life at end of June and when seen on subsequent visits, July 7, 27, and August 17, everything apparently was normal. On August 24, the patient called and reported that she had felt no fetal movements for four days. She was seen on August 31 and no fetal heart tones were heard. She delivered October 2 a macerated fetus from four to five months of age.

CASE 14.—Mrs. W. D. N., aged 32 years, para i, gravida iv, last menstrual period Sept. 23, 1929, was first seen Dec. 9, 1929. Tonsillectomy had been performed on Nov. 29, 1929. When seen on Jan. 3, 1930, everything seemed normal. On Jan. 19, 1930 patient was having contractions and she aborted Feb. 4, 1930.

REFERENCES

(1) *Galloway, C. E.:* Am. J. Surg. New Series **14:** 645, 1931. (2) *Douglass, L. H., and Laughlin, K.:* AM. J. OBST. & GYNEC. **37:** 282, 1939. (3) *McLane, C. M.:* Ibid. **38:** 117, 1939. (4) *Dieckmann, W. J., and Brown, I.:* Ibid. **36:** 798, 1938. (5) *Idem:* Ibid. **38:** 214, 1939. (6) *Galloway, C. E., and Paul, T. D.:* Ibid. **38:** 246, 1939.

Fusimori, H., and Mizuno, K.: Vaginal Porro Operations, Jap. J. Obst. & Gynec. **22:** 119, 1939.

At full term, in order to interrupt pregnancy and produce sterilization at the same time, either a Porro operation is performed after emptying the uterus, or the tubes are ligated following the removal of the baby. In cases before the fourth month, the authors prefer to perform a Porro operation through the vagina. The pregnant uterus is removed supracervically. Since 1934 the authors have done 32 of these operations and with good results in all. Spinal anesthesia was used in these cases. In two instances, stump abscesses resulted, but these were cured by vaginal puncture.

J. P. GREENHILL.

MISSED LABOR*

WILLIAM POMERANCE, M.D., BROOKLYN, N. Y.
(From the Obstetrical and Gynecological Services of the Jewish Hospital)

IT IS the extreme rarity of this type of case together with the many unusual features presented by this case, that prompted its reporting. This term was first used to describe the condition of retention of a full-term, or near full-term, dead fetus within the uterus, beyond the expected date of confinement; it was so used by Oldham[1] in 1847, in reporting a case of a multiparous patient who died three months beyond term carrying the remnants of a full-term fetus; for the two and one-half months preceding her death, portions of the fetus had been removed at several sittings, through the cervix, and just before death it had ulcerated through the uterus into the peritoneal cavity and into the bladder. Since that time the term missed abortion has been applied to a similar retention of a nonviable fetus; much literature has appeared on this subject. While there are many similarities between these two conditions, they would seem from a study of the few cases of missed labor reported in the literature to present sufficient differences to consider them separately.

While most likely the reason for the failure of the uterus to expel its contents is to be found in some endocrinal deficiency, there have been many other reasons offered, such as rigid cervix, cancer, scars, diseased uterus, myomas, muscular degeneration, and cornual pregnancy. As one reviews the case to be presented and the cases noted in the literature, one wonders whether aside from cornual pregnancy, and possibly cancer and fibroids, all the remaining conditions are not part and parcel of the condition of missed labor. Peter[2] mentions a case associated with fibroids that was retained for twelve years (the patient having refused operation), and the finding at post mortem of a mummified full-term fetus in the uterine cavity. Arnold[3] in his discussion of missed abortion mentions the report of a case in "Osservatore Medico" (1834) of a woman who thought herself pregnant for fifty-one years and at post mortem a desiccated full-term child was found in the uterus. Both Williams[4] and DeLee[5] cite the cases of Menzies and Hennig, in which the fetus was retained for 280 and 210 days, respectively, after full term. Lichtwardt[6] reported a case that retained the skeleton of an eight-month-old fetus for a period of twenty-six months, during which 2 fistulas were formed between the fundus of the uterus and the transverse colon, and finally a fistula between the uterus and the anterior abdominal wall. Lakhoti[7] reported the case of a twenty-seven-year-old woman pregnant ten months, who twenty days previously had had a watery discharge from the vagina and finally ulcerated through the abdominal wall and discharged portions of the fetus; this opening communicated with the vagina. Hughes[8] reported a case two months after the expected date of confinement and ten weeks after the death of the fetus with failure of pituitrin to induce labor and termination by cesarean section. Smith[9] reported a similar case of a full-term pregnancy ten weeks after the expected date of confinement and six weeks after the death of the fetus, terminated by cesarean section with the diagnosis between missed labor and abdominal pregnancy in doubt. Potter[10] reported a case that had gone two months after the expected date of confinement and there were cessation of fetal movements and no apparent cervical opening; delivery was effected by cesarean section, a placenta accreta being then found together with many adhesions of the uterus to intestines, omentum, and abdominal wall; these adhesions were thought to have been caused by degeneration of fibroids during pregnancy; they were so extensive as to make hysterectomy impossible.

This condition would appear compatible with good health if no infection sets in, the only complaint then being the difficulty of carrying the large dead weight in the abdomen. From time to time pains of a parturient character may set in, but will subside, as will any vaginal bleeding that may occur. The diagnosis thus offers

*Read at a meeting of The Brooklyn Gynecological Society, October 6, 1939.

no difficulty except in its differentiation from abdominal pregnancy where the proximity of the small parts to the examining abdominal hand may be of help in distinguishing; sounding the uterus or injection of an opaque medium into the uterus may be necessary to distinguish the two. It would seem to the author relatively unimportant to make this differentiation at the expense of the danger of infection since the treatment for abdominal pregnancy and for missed labor if it has progressed for any length of time should be laparotomy. Williams mentions that he has had some success with bougies and bags, but does not state how long after the expected date of confinement intervention was undertaken; possibly if early these may be successful, but if it is done late, the torpidity of the uterine muscle is such that one may use all sorts of local irritants without evoking any pains. An examination of the uterine wall in the case reported, which was of paper thinness, would convince one that labor is impossible. It is even doubtful if delivery from below should be attempted at all because of the danger of producing an infected field if unsuccessful. Further, because of the danger of ulceration into neighboring cavities, the uterus should be emptied as soon as the diagnosis of missed labor is made.

CASE REPORT

J. O., aged 25 years, housewife, born in United States, married three years, had had no previous pregnancies. Family history was negative except for the fact that her mother had had twins. Previous medical and surgical history were negative. Menses commenced at 11, occurred every twenty-eight days and lasted four days; flow was moderate and there was no pain associated with periods. Her last menstrual period occurred Oct. 2, 1937, making the expected date of confinement July 9, 1938.

During the first five months of the pregnancy, she had had vaginal bleeding and upon the advice of her physician was in bed most of this period. Since then no further bleeding had occurred. The patient stated that she first felt life in December. Prenatal course, including blood pressure and urine, was further uneventful (except for a slight amount of reducing substance in the urine) until two weeks prior to her hospital admission (July 10, 1938) when fetal movements ceased. Her physician at this time diagnosed a transverse presentation. Because of the abnormal presentation and the death of the fetus and the absence of labor, he advised hospitalization. She was admitted to the ward service on July 10, 1938, with the additional history that she had a brown vaginal discharge since the previous day.

On examination her temperature, pulse, and respirations were normal. Eyes, ears, nose, throat, heart, and lungs were normal. The breasts were noted to contain colostrum. The abdomen revealed a full-term fetal ovoid in transverse presentation with the head in L.L.Q., breech on right and back anterior; the fetal heart was not heard, and there was some tenderness in the R. L. Q. On rectal examination the cervix was thick and had no dilatation; no presenting part was felt. Vaginal examination revealed a long soft cervix admitting 1 finger, membranes intact, no presenting part in pelvis, some small parts felt through lower uterine segment; the pelvis was normal.

X-ray examination on July 11, 1938 corroborated the transverse presentation and demonstrated marked angulation of the fetal spine. On July 13, 1938 the x-ray further demonstrated some overlapping of the fetal skull bones.

Glucose tolerance test on July 12, 1938 was as follows:

8:00 A.M.	Blood	90 mg. %	Urine	neg.
8:50 A.M.		191		0.008 Gm.
9:45 A.M.		255		0.45
10:45 A.M.		234		0.48

The response was that of a latent diabetic.

July 10, 1938, Urine, sp. gr. 1.020; reaction acid; negative sugar, albumin, acetone and microscopic.

July 11, 1938, R.B.C., 4,500,000, Hg, 78 per cent; W.B.C., 10,000; polymorphonuclears, 70 per cent; lymphocytes, 30 per cent.

July 12, 1938, Blood urea nitrogen, 9.7; uric acid, 3.6.

July 12, 1938, Kline test, negative.

The patient was discharged on July 15, 1938 after an uneventful stay in the hospital; she was cautioned against intercourse and advised to return immediately if membranes ruptured.

Patient was re-admitted to hospital on Aug. 2, 1938 because of vaginal staining and abdominal cramps. She stated she felt fetal movements. The presentation was now more oblique than transverse and the fetal heart could not be heard. She was given castor oil and an enema, but these failed to initiate labor. X-ray examination on Aug. 3, 1938 showed further overlapping of the fetal skull bones. Glucose tolerance test on Aug. 6, 1938 showed a more normal response. Patient was discharged on Aug. 6, 1938 to return to the prenatal clinic.

Blood pressure and urine examinations on September 1, October 2, October 10, and November 14 were normal. A few days after the September 1 visit she had some bright red staining which promptly subsided. At this same visit a presenting part was noted in the pelvis, believed to be vertex; and the fundus measured 33 cm. She stained again on October 7 to 10. During all this time patient stated she felt life and that her abdomen was growing. X-ray on October 1 demonstrated further overlapping of fetal skull bones and more marked angulation of the spine. Vaginal examination on November 14 revealed a cervix about 0.5 inch long, soft, closed, and vertex presenting. She noted some brown vaginal staining for several days in the beginning of November.

Patient was again admitted to the hospital on November 21, 1938. At this time no secretion was noted in the breasts. The fundus measured 32 cm. On vaginal examination the cervix was noted to be firm, about 1 inch long and closed; also an indefinite bulging on left side of lower uterine segment was noted. The pregnancy appeared to be intrauterine, although no definite uterine contractions could be elicited. General condition of the patient was excellent.

In spite of the fact that it was felt that the pregnancy was probably intrauterine, steps were considered to establish this beyond question of a doubt. Digital examination and sounding were decided upon rather than lipiodol injection, but were deferred until endocrinologic study could be completed. On November 27 a low twenty-four-hour output of estrin (65 R.U.) was reported together with a strongly positive prolan. Vaginal smear on November 28 showed 1-plus estrin effect and pH was 7.0. Patient was then given 300,000 I.U. of progynon B every eight hours for a total of 900,000 I.U. plus 2 mm. of pituitrin every two hours for 6 doses without producing any uterine contractions. After the second dose of progynon, pH of vagina was 5.0 and smear showed 4-plus estrin effect. On the day following the completion of the administration of the estrogens, the cervix was found to be shortened, considerably effaced and admitting a tip of a finger. A further course of pituitrin (2 c.c. every hour for 6 doses) was given but with no effect. On November 22 and 29 Aschheim-Zondek tests were reported negative.

On Dec. 1, 1938, almost five months after the expected date of confinement, the patient was taken to the delivery room and examination done under anesthesia. The cervix was found to be 1.5 inches long, rigid, external os just admitting a small dilator. In the left fornix a head could be felt which was apparently intrauterine. After dilating the cervix with Hegar dilators up to No. 18, the index finger was forced through the internal os and the vertex was felt to the left with the aid of pressure from above. A dense piece of tissue intervened between the head and the examining finger. A sound passed very easily to the right without meeting any obstruction.

It was now decided to observe the patient for about one week and if the temperature remained normal, to perform laparotomy then.

The following day (December 2) her temperature rose to 102.8° F. and some spasticity and tenderness of the uterus were noted. On December 3 the temperature was similarly elevated and the tenderness was more marked in the R.U.Q. and R.L.Q. over the uterus with definite rebound tenderness. The white blood count was 25,000 with 90 per cent polymorphonuclears. On this day she passed a large worm (*Ascaris lumbricoides*) in the stool. A blood culture was taken and sulfanilamide medication was started. On December 4 moderate cyanosis of the lips was noted. She was given intravenous glucose in addition to the sulfanilamide. On this night crepitation over the right side of the uterus was noted, about 4 inches in diameter

and to the right and above the umbilicus. Gas bacillus serum was immediately administered and transfusion ordered. The following morning (December 5) with the temperature 103.8° F., there was a resonant percussion note over the entire uterus. Patient was transferred to the gynecological ward on the service of Drs. Schwartz and Wolfe, where the cervix was exposed and found to be swollen, edematous, and covered by a shaggy exudate. The os was found and admitted a small dilator; internal os could not be passed and was not forced. Applicators were used to obtain cultures. X-ray examination at this time demonstrated air around the fetus anteriorly and superiorly within the uterine cavity; no air could be demonstrated in the soft tissues of the abdominal wall. On December 6 with her general condition becoming progressively poorer in spite of sulfanilamide and gas bacillus serum, and definite evidence of spread of the crepitant area of the uterus, exploration was decided upon.

Operation.—The field was blocked with 1 per cent novocaine and a right pararectus incision made. As the parietal peritoneum was opened one could hear gas escaping. No evidence of pus or generalized peritonitis was observed. The right upper portion of the uterus was adherent to the abdominal wall. As these adhesions were

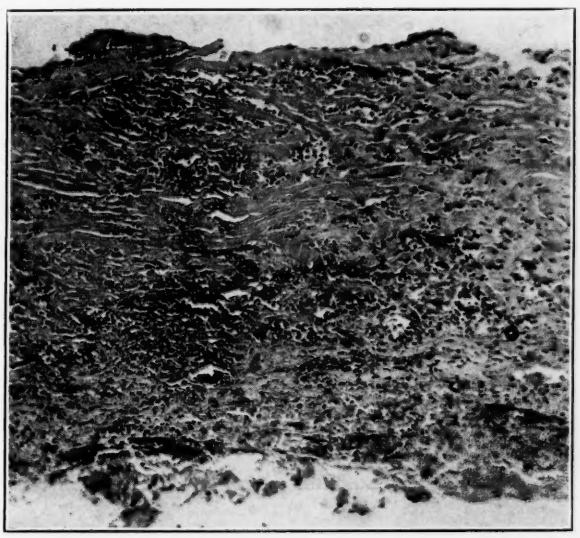

Fig. 1.—Section through entire thickness of uterine wall, demonstrating extreme thinness, necrosis of muscle fibers, and dense cellular infiltration. (×200.)

freed, escaping gas was heard. The anterior bladder reflection was attached high up to the fundus by additional adhesive bands. Adhesions were noted binding the uterus to both lateral pelvic walls. These adhesions appeared to be evidence of an older infection. Posteriorly on the left the sigmoid was intimately adherent to the body of the uterus. The omentum was found adherent posteriorly to the uterus, and a perforation (size of a dime) of the uterus was noticed in the right posterolateral portion of the lower uterine segment. About 200 c.c. of sanguinopurulent fluid escaped from the cul-de-sac of Douglas as this area was explored. Just superior to this and on the posterior surface close to the fundus, a circumscribed area of softening was noted in the wall of the uterus; omentum was plastered over this point in an effort to seal it off. The uterus itself was thin walled, of a pinkish white hue, and gas was felt in its cavity. When the uterus was opened no fluid was obtained. An oversized macerated fetus, measuring 57 cm., was found undergoing decomposition. Necrotic tissue of a fecallike appearance was found in the cavity. When the uterus was opened, gas escaped. The placenta and membranes were firmly adherent to the uterine wall. The endometrium was covered by a light

brown exudate which was dry and gritty. There was very little bleeding from the uterus which was paperlike in thinness.

Procedure.—Adhesions binding the uterus were freed. The uterus was mobilized and brought out on the abdominal wall. Posteriorly the sanguineous pus could be seen welling up into the wound. The abdominal cavity was walled off with tapes and the uterus was opened. Macerated fetus was removed; cord cut, placenta and membranes removed with difficulty, some of the latter remaining behind adherent to the uterus. The uterus was now a thinned-out sac and collapsed with no bleeding. As much of the wall of the uterus was removed as possible, more extensive excision being restricted because of the high bladder and the adherent sigmoid. All bleeding points were ligated. Bleeding points of omentum freed from the uterus were tied. The remaining uterine wall was sutured at the angles. Iodoform strips were placed in the remaining uterine cavity. The stump of the uterus now was exteriorized by suturing the wall of the uterus to the abdominal parieties.

Fig. 2.

Fig. 3.

Fig. 2.—Section through entire thickness of wall of uterus with adherent portion of placenta, demonstrating also exudate on peritoneal surface. (×60.)

Fig. 3.—Section through placenta demonstrating ghosts of chorionic villi and calcification. (×60.)

Through-and-through sutures of interrupted chromic catgut No. 2 were used to close the abdomen, including the peritoneum, muscle, and fascia. Two cigarette drains were placed in the cul-de-sac and 2 in front of the uterine stump. Skin was closed with interrupted black silk sutures.

Patient received 500 c.c. of citrated blood and intravenous glucose.

Patient's condition continued grave, temperature ranging between 103° and 106° F. Abdominal distention was combated with Wangensteen apparatus. Sulfanilamide, serum, and blood transfusions continued. Slight icterus was noted on second day postoperative; but condition at this time appeared slightly improved. On third day postoperative patient became disoriented and condition grew progressively worse, and she died on the fifth postoperative day.

Pathologic Reports.—Microscopic examination of the placenta showed acellular tissue in which ghosts of former chorionic villi and decidual cells could be seen. Scattered through it were numerous small and large deposits of calcium.

Preparation from the wall of the uterus showed at one end a fibrinopurulent exudate with clumps of purple-blue staining material adherent to the wall. Here there were occasional papillary stalks covered with cylindrical cells. The wall itself was thin, composed of loose fibromuscular tissue infiltrated by many polymorphonuclear leucocytes, eosinophiles, small round cells, and large mononuclear cells. In the deeper portions, the tissue was necrotic, acellular, and contained numerous small and large deposits of calcium. Another preparation showed the endometrial surface covered by cylindrical cells and in places attached to it was a fibrinopurulent exudate; within the wall the tissue was loose with numerous distended thin-walled vessels filled with polymorphonuclear leucocytes, and throughout a dense infiltration by similar cells.

Livers from rabbits injected with cervical swab were compatible with that seen in gas bacillus infection.

December 8, Total sulfanilamide, 8.7 mg. %; free sulfanilamide, 7.5 mg. %
December 9, Total sulfanilamide, 8.3 mg. %; free sulfanilamide, 7.6 mg. %
Icteric index, 34.6
Blood chlorides, 400 mg. %.
December 6, Culture of peritoneal fluid obtained at operation, *B. welchii*.
R.B.C., 3,850,000; Hg, 81%; W.B.C., 28,200, polys 82%
December 8, R.B.C., 4,240,000; Hg, 81% W.B.C., 15,000, polys 82%
December 10, R.B.C., 2,960,000; Hg, 59%; W.B.C., 7,200, polys 80%

SUMMARY

1. The rarity of the condition presented is noted.

2. Cases reported in the literature are briefly reviewed.

3. There appears to be an association of abdominal adhesions and ulcerations into neighboring cavities in cases of missed labor of some duration, especially in the presence of infection.

4. The uterus should be emptied as soon as the condition is diagnosed.

5. The route should be abdominal because of the difficulty in differentiating abdominal pregnancy, and because if attempts (other than medical) at induction are unsuccessful, infection may ensue.

6. A case is presented that carried five months beyond the expected date of confinement with the patient remaining in good health except for somewhat regular occurrence of slight abdominal cramps and some vaginal staining; at the end of five months, the uterus was accidentally perforated by a uterine sound introduced to help establish the diagnosis of an intrauterine pregnancy, with introduction of a *B. welchii* infection and death of the patient in spite of emptying of the uterus, sulfanilamide, and gas bacillus serum.

7. The thinness and necrosis of the uterine musculature is demonstrated.

8. Some endocrinologic studies of this case are presented.

I wish to thank Drs. Schwartz, Blum and Wolfe for the privilege of reporting this case.

REFERENCES

(1) *Oldham:* Guy Hospital Reports **5:** 105, 1847. (2) *Peter, L. C.:* Am. J. Obst. **14:** 138, 1899. (3) *Arnold, H. R.:* Am. Med. **22:** 475, 1927. (4) *Williams, J. W.:* Obstetrics, ed. 7, New York, D. Appleton-Century Co., p. 929. (5) *DeLee, J. B.:* Obstetrics, ed. 5, Philadelphia, W. B. Saunders Co., p. 515. (6) *Lichtwardt, H. A.:* Arch. Surg. **21:** 157, 1937. (7) *Lakhoti:* Indian M. Gaz. **67:** 267, 1932. (8) *Hughes:* M. J. Australia **1:** 355, 1922. (9) *Smith:* J. Obst. & Gynaec. Brit. Emp. **28:** 549, 1921. (10) *Potter, M. G.:* Am. J. Obst. & Gynec. **36:** 1066, 1938.

140 Eighth Avenue

BIPARTITE UTERUS*

E. L. BENJAMIN, M.D., AND W. C. DANFORTH, M.D., EVANSTON, ILL.

(From the Department of Pathology and Department of Obstetrics and Gynecology of Northwestern University Medical School and of the Evanston Hospital.)

WE DESIRE to report an unusual case which has recently been seen on our service.

In May, 1939, a 23-year-old white woman, tripara, entered the Evanston Hospital in labor. The labor was normal and rapid. A child weighing 3,540 Gm. was delivered spontaneously. The anus was imperforate; no external urethral orifice could be seen. What appeared to be the clitoris was much larger than normal. The infant was cyanotic at birth, and later the skin had a dusky hue. Fourteen hours after delivery the abdomen became distended. On the following morning fluid trickled from a pin-point opening in the external genitalia. From the second day on meconium-like material was regurgitated at frequent intervals. Watery fluid, apparently urine, was observed coming from the umbilical cord.

Fig. 1.—Roentgenogram taken with the patient in an inverted position. Arrows point to two fluid levels in the bipartite uterus. The third, fourth, fifth sacral vertebras and coccyx are absent.

A roentgenographic examination on the day of delivery disclosed gas in the bowel at the level of the first and second lumbar vertebrae, which indicated gas in the small bowel, none having passed into the sigmoid and rectum. The nature of the obstruction could not be determined. A second roentgenologic examination (Fig. 1) two days after birth revealed a pocket of gas over two fluid levels in the true pelvis and lower abdomen. This was interpreted as gas in a hollow viscus, probably bladder. The possibility of the gas being in a distended loop of bowel was also considered.

The signs of obstruction and abdominal distention continued. Surgical intervention appeared useless. Death occurred on the fifth day after birth.

*Presented at a meeting of the Chicago Gynecological Society, October 20, 1939.

The necropsy was performed four and one-half hours after death. Only the pertinent findings are reported. The body of the full-term female infant weighed 2,990 Gm. It was 45 cm. long. The thin, glistening skin was stretched tightly over the markedly distended globoid abdomen. Yellow, turbid fluid escaped from the encrusted umbilical stump. The anus was absent; in its place was a triangular-shaped bulge of skin containing a central anal dimple. The vagina was absent. The external genitalia were formed by two lateral folds, 25 mm. long, 11 mm. wide, and 15 mm. high. Between them was a longitudinal fold, covered with skin, 15 mm. long, 5 mm. wide, and 10 mm. high. Its cephalic pole was covered with a small cap of skin. The only external opening present was a 2 mm.

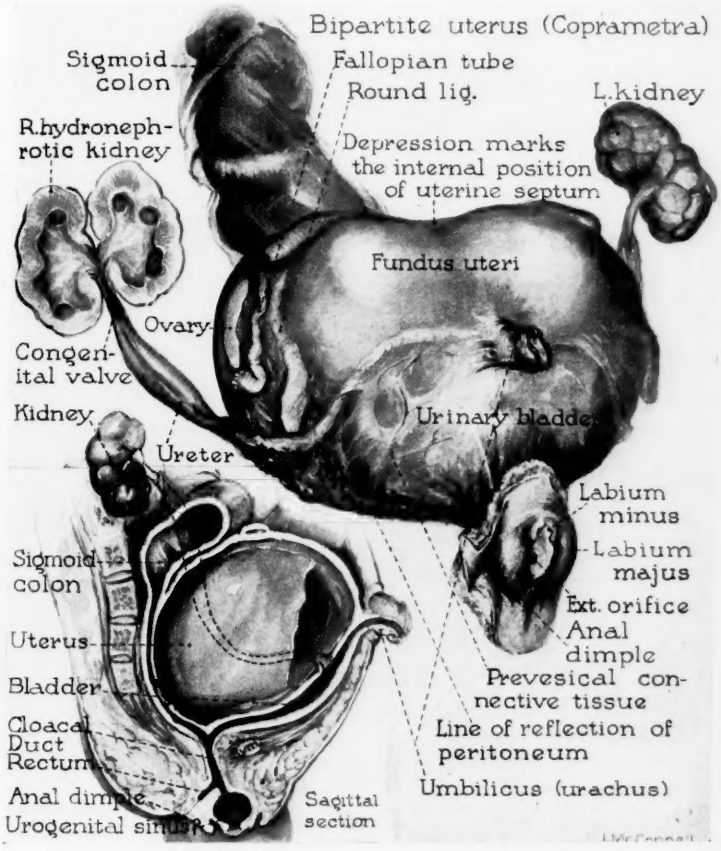

Fig. 2.—Ventral view of sigmoid colon, genitourinary structures, and attached external genitalia and anal region. The smaller drawing is a reconstructed semidiagrammatic sagittal view.

orifice in the midportion of the central longitudinal fold to the right of the midline. A turbid, dark yellow fluid escaped from this orifice when pressure was applied to the abdomen. No other gross external abnormalities were seen.

Upon opening the body cavities, the diaphragm was found elevated. The heart, aorta, and thymus were normal. The compressed lungs were dark red, mottled purple, subcrepitant, and somewhat meaty in consistency, although they floated in water.

Striking anomalies were found in the urogenital organs (Figs. 2 and 3). All but the upper third of the abdominal cavity was occupied by a distended, thin-walled, cystic uterus, adnexa, and urinary bladder, arising from the pelvis. The top of the uterus was 10.5 cm. above the symphysis pubis. The uterus was roughly pyramidal in shape; its base had assumed a cephalic and its apex a caudal position.

It measured 14 cm. from apex to base. The anteroposterior diameter was 12 cm.; the greatest transverse diameter was 13 cm. The fundus of the uterus presented a median anteroposterior shallow depression which marked the position of the internal sagittal septum of the uterus. Each lateral aspect of the fundus presented an elevated mound, representing the cornu from which passed an infantile Fallopian tube 42 mm. long. A narrow, flat infantile ovary, 27 by 8 by 2 mm., was located just posterior to the Fallopian tube. The adnexa hugged the convexity of the lateral margins of the distended uterus. The uterine ligaments were either absent, distorted, or grossly obliterated. The anterior ligaments were absent. The intimate relation of the urinary bladder, to be described, and the ventral uterine wall precluded the possible formation of the vesicouterine excavation. The absent vagina and an incompletely developed rectum explained the failure of development of the rectovaginal folds and the lack of formation of the posterior ligaments. The rectouterine folds and pouch of Douglas were

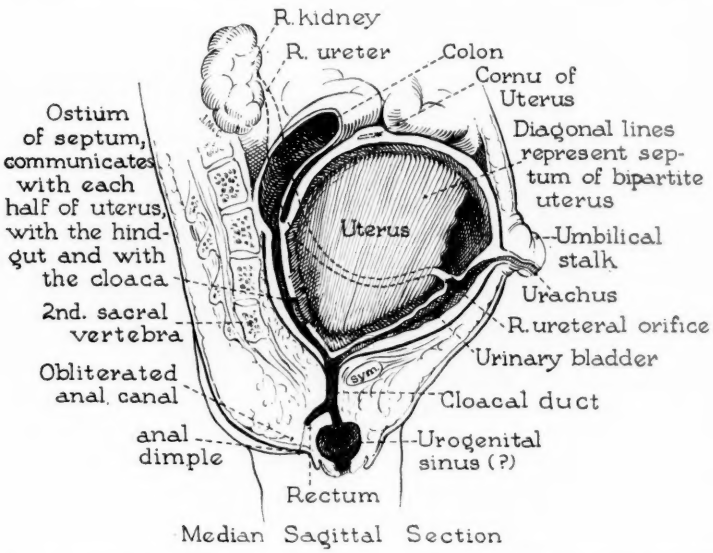

Fig. 3.—Semidiagrammatic median sagittal section of lower abdomen and pelvis.

absent for similar reasons. The abdominal parietal peritoneum formed a short angle of reflection as it passed over the uterus and formed two delicate layers to enclose the Fallopian tubes, the ovaries and their ligaments, and associated vessels and nerves. The ascension of the distended uterus and attached urinary bladder obliterated a pelvic-peritoneal cavity. The round ligaments passed over the distended uterus and veered ventralward.

The stretched walls of the body of the uterus were 3 to 4 mm. thick. The wall at the cornu was 10 to 12 mm. thick. A sagittal partition, 2 mm. thick, divided the uterus. Each half was almost filled with a dark yellow, turbid fluid (urine and fecal material). An oval ostium, 6 mm. in its vertical diameter, located in the middorsal margin of the septum, formed a communication between each half of the uterus and a tubular structure enclosed within the dorsal margin of the septum.

The colon entered the superior surface of the uterus to become enclosed in the dorsal margin of the uterine septum. The lumen of the distended large bowel was reduced to 3 mm. in diameter at its point of entrance into the uterine septum. The bowel then abruptly increased to a diameter of 10 mm., passed 4 cm. caudad in the septum, at which point its lumen again became reduced to 5 mm., where it communicated with each half of the uterine cavity through the above-described septal ostium. It then continued as a narrow tubular structure or persistent "cloacal" canal to communicate with the internal meatus of the urinary bladder just beneath the symphysis, 3 cm. below the septal ostium.

The flattened, triangular-shaped urinary bladder was intimately attached to the convex ventral uterine wall, from the level of the umbilicus above to the level of the symphysis below. It was 6 cm. long. The transverse diameter of the fundus was 2 cm. The bladder tapered from above downward. A patent urachus passed from the fundus of the bladder through the umbilical stalk. Each ureter entered the superior lateral border of the urinary bladder. The lower extremity of the bladder had an internal meatus 4 mm. in diameter, which communicated just beneath the symphysis pubis with the "cloacal" canal. The canal from the internal meatus of the urinary bladder to the external opening was 35 mm. long. Twenty-three millimeters distal to the former, a blind tubular rectum, 6 mm. long and 1 mm. wide, took its origin from the posterior wall of the "cloaca" and passed dorsocaudad to end 5 mm. from the anal dimple. A slender, white, glistening cord of tissue connected the blind end of the rectum to the skin of the anal dimple. Five millimeters distal to the origin of the blind rectum the "cloacal" canal presented a spherical outpouching 15 mm. in diameter, which may be considered a persistent urogenital sinus. The distal border of the "urogenital sinus" was 2 mm. from the external opening of the "cloaca."

The kidneys were in the normal position. The ureters coursed dorsoventrad over the cystic uterus to enter the bladder. The right kidney measured 50 by 30 by 14 mm. Surfaces made by sectioning displayed a distinct cortico-medullary differentiation. The pale cortex was 2 mm. thick; the pink gray medulla was 4 to 6 mm. thick. The circumference of the ureteropelvic junction was 5 mm. Ten millimeters below the junction a fold of mucosa formed a semilunar valve. The circumference of the ureter above the valve was 10 mm. and below, 22 mm. It contained turbid urine and the smooth mucosa was white.

The left kidney was 53 by 25 by 14 mm. It resembled the right. The circumference of the ureteropelvic junction was 6 mm. Fifteen millimeters below the junction the ureter contained a semilunar valve similar to the right. The circumference above the valve was 6 mm. and below, 20 mm. The ureter was also filled with turbid urine and the mucosa was smooth and white.

The third, fourth, and fifth sacral vertebras and the coccyx were absent. The third, fourth, and fifth sacral and coccygeal nerves were absent. The spinal cord and brain were not examined.

Histologic observations of hematoxylin and eosin-stained sections of paraffin-embedded tissues fixed in a 10 per cent solution of formaldehyde, were as follows:

The incompletely expanded infantile parenchyma of the lung revealed vascular engorgement, focal hemorrhages, edema, and a slight pneumonitis. There was granular degeneration of the renal epithelium affecting particularly the convoluted tubules. An occasional small group of erythropoietic cells were in the sinusoids of the liver. Moderate fatty change had affected the central zones of the hepatic lobules. The splenic sinusoids contained histiocytes filled with coarse, brown, granular pigment. A microscopic, encapsulated cortical adenoma and focal hyperplasia of the zona reticularis of the suprarenal glands were present. Sections of the ovaries and Fallopian tubes were normal. The wall of the fundus uteri was formed by thin, stretched, irregular smooth muscle bundles lined by a poorly developed cytogenic membrane in which were dispersed a few fetal type endometrial glands. The lower portion of the uterus was lined by one or two layers of flattened pavement cells. A similar mucosa covered the septum and formed the lining of the cloaca, urogenital sinus, and rectum.

The colon, located within the septum, was lined with a partially autolyzed membrana propria. Its tunica muscularis was united to the septum by a thin fibrous layer. Sections of blocks taken on an oblique plane through the body wall between the blind end of the rectum and the anal dimple were composed of skeletal muscle bundles separated by a small amount of connective tissue, covered by panniculus adiposus and skin. Serial sections through this region should have been made to permit adequate study of the grossly described delicate cord connecting the blind end of the rectum to the anal dimple. It is thought this cord was an obliterated anal canal.

From an analysis of the developmental abnormalities encountered in the present report it would appear that during the sixth week of embryonic life complete division of the cloaca was arrested, resulting in its partial separation at its cranial

and caudal extremities. Only the urinary bladder developed from the vesicourethral anlage. The urachus did not lose its connection with the umbilicus. The corresponding dorsal region of the cloaca became constricted and elongated to form a narrow rectal tube whose cranial extremity, continuous with the colon, became enclosed between the medial walls of the approximated caudal extremities of the paired Müllerian ducts (uterine septum). The midportion of the cloaca, which failed to undergo division, remained as a cloacal duct. It became elongated and constricted. The caudal extremity of the common cloaca became separated to form a dorsal rectum and ventral urogenital sinus. The clitoris and vaginal vestibule failed to develop. The slender cord of tissue connecting the blind end of the rectum to the skin at the site of the imperforate anus may have been an atretic proctodeum or obliterated anal canal. Normally the anal orifice is formed by the rupture of the dorsal cloacal membrane at the seventh week.

The longitudinal cranial portion of the paired Müllerian ducts developed normally into the Fallopian tubes. From the middle transverse portion developed the uterine fundus and corpus. A sagittal uterine septum persisted because the united uterine primordia failed to fuse. The caudal extremity of the hind-gut and the cranial portion of the rectum were enclosed in the dorsal margin of the merged medial walls of the uterine anlage. The ostium in the dorsal margin of the uterine septum that communicated with the hind-gut probably represented the earlier communication between the Müllerian ducts and the urogenital sinus, which normally occurs about the middle of fetal life. The absent uterine cervix and vagina may be explained by agenesis of the uterovaginal primordium.

The so-called "ureteral valves" present in the upper portion of each ureter are considered to be duplications of the ureteral mucosa. In this case the valves and the compression of the ureters caused a moderate bilateral hydroureteropyelonephrosis. According to H. Young, Wölfer found valvular formations in 20 of 100 newborn children and Motzfeld attributed 9 of 21 causes of hydronephrosis to ureteral valves. Englisch observed ureteral valves in human embryos of four months.

SUMMARY

The necropsy of a five-day-old, full-term female infant exhibited the following abnormalities of the urogenital system: Bipartite uterus; absent cervix, urethra, vagina, and clitoris; persistent cloacal duct, caudal urogenital sinus, urachus; an imperforate anus and obliterated anal canal. The hind-gut and the cranial portion of the rectum were enclosed in the dorsal margin of the uterine septum. An opening in the dorsal margin of the uterine septum, at the level of the junction of the colon and rectum, formed a communication common to the bowel and each half of the uterine cavity. The thin-walled corpus uteri was distended with feculent fluid (coprametra). These congenital defects are explained by incomplete division of the cloaca, failure of fusion of the midportion of the primordium; agenesis of the uterovaginal, urethral, and phallic anlage. Pressure on the caudal extremity and the presence of a "ureteral valve" in the cranial third of each ureter caused a bilateral hydroureteropyelonephrosis. Absence of the last three sacral vertebras and the coccyx was due to agenesis of the corresponding sclerotomes. The third, fourth, fifth sacral and coccygeal nerves were absent. Pulmonary atelectasis, congestion, edema, focal hemorrhages, and pneumonitis were terminal.

The bipartite uterus, communicating with the dorsal gut and filled with fluid and gas, accounted for the double fluid level seen in the roentgenogram taken on the second day.

REFERENCES

(1) *Pohlman, A. G.:* Am. J. Anat. **12:** 1, 1911. (2) *Arey, B. A.:* Developmental Anatomy, ed. 3, Philadelphia, 1937, W. B. Saunders Co., p. 252. (3) *Politzer, G.:* Quoted by Arey, ibid., p. 252. (4) *Koff, A. K.:* Quoted by Arey, ibid., p. 265. (5) *Keibel, F., and Mall, F. P.:* Manual of Human Embryology, ed. 1, Philadelphia, 1912, J. B. Lippincott Co., pp. 869-874. (6) *Young, H. H., and Davis, D. M.:* Young's Practice of Urology, ed. 1, Philadelphia, 1926, W. B. Saunders Co., pp. 50-51.

2650 Ridge Avenue

FULL-TERM PREGNANCY COMPLICATING CARCINOMA OF THE CERVIX*

ISIDORE DAICHMAN, M.D., F.A.C.S., AND EARLE M. WILDER, M.D.,
BROOKLYN, N. Y.

(From the Obstetrical Service of the Jewish Hospital)

P. N., a 31-year-old Italian woman, made her first visit to the prenatal clinic Feb. 8, 1938. The family history and past medical history were completely negative. Menses began at 12 years of age, occurred every thirty days, and lasted seven or eight days. The bleeding has always been moderate in amount, and there has never been any dysmenorrhea, meno- or metrorrhagia. Last normal period July 15, 1937. Life was felt in October, 1937. Labor was expected on March 22, 1938. Marital history: Patient's husband had syphilitic cardiovascular disease for which he was being treated. She had had 6 children, all living and well; all delivered at home, weighing from 7 to 9½ pounds. All her labors had been easy. The oldest child was 13 years, the youngest 18 months. Wassermann test on the patient and on the children was reported negative. There were no stigmas of syphilis noted.

At this first visit to the clinic, physical examination revealed a short systolic blow at the apex, normal blood pressure and urine, normal pelvic measurements and an apparently normal seven and one-half months pregnancy. The cervix was soft and badly lacerated posteriorly, and the pelvic floor was markedly relaxed. Patient stated that she felt perfectly well during this pregnancy except for slight vaginal bleeding for one day each month. In October, 1937, she was admitted to another institution with an admission diagnosis of "probable tumor of the uterus." Correspondence with this hospital disclosed the fact that she was discharged after a three-day stay with a diagnosis of pregnancy. Examination at this hospital is reported as completely negative except for an irregular scar on the posterior lip of the cervix.

The patient made her second prenatal visit on March 8, 1938, at which time nothing unusual was noted. She returned again two weeks later, March 22, 1938, complaining of a slight show of blood. Examination showed the badly lacerated cervix extremely friable and it bled easily when touched. A small piece of tissue found on the examining finger was sent to the laboratory with a clinical diagnosis of possible malignancy of the cervix. The pathologic report came back March 25, 1938 as squamous cell carcinoma of the cervix.

The patient was admitted to the hospital on March 25, 1938. Examination at this time showed a somewhat poorly nourished, white woman of 31 years, with a full-term pregnancy. The vertex was dipping into the brim, and the fetal heart was heard in the left lower quadrant. Blood pressure was 120/70. Hemoglobin 57 per cent, red blood count 3,500,000; white blood count 8,500, polymorphonuclears 78 per cent. Urine negative. Heart normal except for a short systolic blow at apex. Lungs clear. Vaginal examination showed a relaxed pelvic floor and the posterior lip was described as lacerated, very firm, nodular, and irregular. The anterior lip was soft and smooth. The firmness involved the entire posterior lip as well as both lateral aspects of the cervix. In brief, the malignancy apparently involved over two-thirds of the entire cervix except for a small anterior portion. These areas were firm and nodular, not merely at the external os, but the firmness extended for about one inch in the long axis of the cervical body. The fornices were apparently free. Rough granular tissue found on the examining finger was again sent to the laboratory and the report came back once more "squamous cell carcinoma of the cervix."

One day after admission to the hospital, March 26, 1938, the patient began to have mild uterine contractions. Because of the degree of cervical involvement with its possible dangers of laceration, hemorrhage and sepsis, delivery by the abdominal

*Presented at a meeting of the Brooklyn Gynecological Society, October 6, 1939.

route was decided upon. Under general anesthesia, a normal female infant of 8½ pounds was delivered by classical section, after which a supracervical hysterectomy and bilateral salpingo-oophorectomy were done. Both broad ligaments were found to be quite free, and there was no evidence of extension of the neoplasm to the pelvic tissues.

The postoperative course was complicated by a low grade pneumonitis and a moderate secondary anemia, both of which responded to therapy. On the tenth day postoperative, the patient was transferred to the Radiotherapy Department for treatment of the cervical neoplasm.

From April 6 to May 9, 1938, the patient by deep x-ray received a total of 4,800 r. units, in daily treatments of 200 r. units each. A second course of 4,800 r. units was given from May 18 to June 16, 1938. Total x-ray therapy was 9,600 r. units.

On April 27, 1938, her condition seemed fair, and she had gained several pounds. Bloody vaginal staining persisted. The abdominal scar was firm and healed by primary union. The cervical stump was high in the vaginal vault and seemed to be adherent to the lower angle of the abdominal incision. The cervix was short, firm, and irregularly nodular throughout its entire extent. The finger could be inserted into the external os where it came in contact with friable tissue anteriorly and to the right. Moderate bleeding was caused by the examination.

On May 27, 1938: She had gained one pound in the past month and felt stronger than a month ago. She had had one episode of moderate vaginal bleeding. Abdominal scar was firm. The cervical stump was adherent to the lower angle of the abdominal scar. The external os was stenotic, flush with the vaginal vault, cartilaginous in feel and quite irregular. Fornices were free. There was slight bleeding on manipulating the cervix. Growth had apparently not yet involved the parametrial areas.

On June 17, 1938: There was no loss in weight. Occasionally there was slight vaginal bleeding, but no urinary or gastrointestinal symptoms. There was slight but definite early infiltration of both parametrial areas. Growth was still present in the cervix, which was flush with the vaginal vault.

On July 5, 1938, the patient was readmitted to the hospital for radium therapy. In the interval, she had gained five pounds and felt subjectively improved. At this time the hemoglobin was 40 per cent, and red blood count 2,600,000. Urine negative. Vaginal examination showed the cervix to be almost completely destroyed. In its place was a small stump with a superficial crater in its center. There was some infiltration of the parametria without fixation of same. Classified as early Grade B (Schmitz). She was given 6,500 mg. hr. of radium without reaction. Discharged July 11, 1938.

Patient again admitted to hospital July 21, 1938, with a diagnosis of a left sided pyelitis. Vaginal examination showed the cervix to be destroyed. There was an ulcerating crater at the vault. Bilateral parametrial tension was noted, more marked on left side. Excretory urography showed normal function of both kidneys and no ureteral obstruction. Hemoglobin was 62 per cent; red blood count, 3,150,000. Urine showed albumin, pus cells, and clumps. The pyelitis responded to simple therapy and patient was discharged Aug. 8, 1938.

Examination in the clinic on Nov. 28, 1938, showed her general condition to be excellent. There were no subjective symptoms. No vaginal bleeding. Vaginal examination showed epithelization of the vault and practically no parametrial thickening.

Patient again admitted to the hospital Feb. 13, 1939, for additional radium therapy. Two weeks prior to admission, she began to have brownish vaginal staining, urinary frequency and burning. Vaginal examination showed nodular infiltration of anterior vaginal vault which was somewhat ulcerated again. Two radium bombs were applied directly to the indurated vault and the patient was given 2,600 mg. hr. of radium. At this time, her general condition was quite good. She had gained 20 pounds in ten months and felt quite well. Hemoglobin was 88 per cent; red blood count, 4,500,000. Urine was negative. A urogram done on Feb. 16, 1939, showed normal function of both kidneys, and a slight distention in the lower left ureter which was interpreted as probably being due to early ureteral involvement by the neoplastic process. Discharged March 2, 1939.

The last admission to the hospital was on June 19, 1939, with the following history: The patient was well until April, 1939, when she began to have burning and pain in the rectal region and some rectal discharge. These symptoms were thought to be due to the previous radiation therapy. These symptoms improved for a while, but returned again in the month of May. During May, vaginal examination in the clinic showed nodular infiltration of the vaginal vault with some ulceration and sloughing. Both parametrial areas were contracted, indicating lateral involvement. The patient's general appearance was very poor and she had become completely incapacitated. She had lost a good deal of weight and had become quite weak. One week before admission she developed severe lower abdominal cramps and diarrhea. On June 19, hemoglobin was 74 per cent; red blood count, 3,700,000. Urine was negative. An intravenous urogram done on June 23, 1939, showed a right-sided hydronephrosis not present in the previous pyelogram (February, 1939). This was interpreted as being due to pressure of the pelvic neoplasm on the right ureter. On June 26, 1939, the following note was made: "the patient looks markedly cachectic. Skin is dry, pale and loose, showing evidence of much recent weight loss. Vaginal examination shows a gravish discoloration of the very short cervical stump and anterior vaginal vault. These structures seem to be markedly infiltrated anteriorly, posteriorly and in both parametrial areas, so that the impression of a completely frozen pelvis is obtained. Moderate bleeding noted during examination."

Under conservative therapy of bed rest and sedation, the patient improved somewhat subjectively, the pain being less pronounced than on admission. She was discharged July 7, 1939, and institutional care in a chronic hospital was advised.

On Aug. 13, 1939, the patient was admitted to the Cancer service of the Kings County Hospital, and three days later she was transferred to St. Rose's Home, a home for incurables, in the Bronx. From this institution she was transferred to Welfare Island. For a long while, she was on the critical list, and according to the last inquiry a few days ago, she was said to be slightly improved. Her general condition was so poor, however, that death from either uremia or cachexia will undoubtedly occur very shortly.

SUMMARY

A case of full-term pregnancy associated with a fairly extensive cancerous involvement of the cervix is presented. The diagnosis of malignancy was first made four days before the patient went into labor. Delivery was accomplished by cesarean section followed by supracervical hysterectomy because of the degree of cervical involvement by the malignancy. As soon as the abdominal incision was healed, deep x-ray therapy was begun. This was given over a two-month period, so that the patient got 9,600 r. units. Shortly after this, 6,500 mg. hr. of radium were given. Several months later, additional radium (3,600 mg. hr.) was used. In spite of intensive radiotherapy, the malignant process, which in the first eight or nine months seemed to be under control, spread slowly but definitely. At the end of the first year, there was beginning involvement of the lower end of the left ureter, although the patient's general condition was still fair. By the end of fifteen months, there was a marked right hydronephrosis, and the patient was rapidly going downhill, with marked cachexia, abdominal cramps, and diarrhea. A frozen pelvis was present by this time. At the end of seventeen months the patient was on the critical list at Welfare Island, with the prospect that she would not live more than a few weeks.

SIMULTANEOUS EXTRA- AND INTRAUTERINE PREGNANCY*

BENJAMIN LEFF, M.D., AND DAVID R. MERANZE, B.S., M.D.,
PHILADELPHIA, PA.

(From the Departments of Gynecology and Pathology, Mount Sinai Hospital)

UP TO date approximately 300 cases of combined extra- and intrauterine pregnancies have been reported.[1] An extensive review was made by Neugebauer[2] who completed two studies, one in 1907 and the other in 1913, collecting a total of 244 cases. In 1926 Emil Novak[3] made a comprehensive study of the subject. He added 32 cases collected from the literature and reported two of his own, bringing the total at that time up to 278.

Of interest in addition to its comparative rarity, is the difficulty of accurate diagnosis. Of the 278 cases collected by Neugebauer[2] and Novak,[3] only 6.5 per cent were correctly diagnosed preoperatively.

One of us (B. L.) was called to see Mrs. F. C., a white woman, aged 39 years, who complained of vomiting, abdominal distention, and severe abdominal pain, radiating to her right shoulder. The patient was constipated. These symptoms first occurred two days previously. Her last regular menstrual flow had taken place two months ago. No bleeding had occurred since. She volunteered the information that she was pregnant for the tenth time. She has eight living children. On physical examination, the following were noted: Temperature 98.3° F., pulse 76, blood pressure 120/65. The patient appeared comfortable, color good, and skin dry. The abdomen was distended, and generalized, moderate tenderness was noted on palpation, particularly marked over the gall bladder and appendiceal regions. Vaginal examinations done when the patient was first seen and two days later, prior to a laparotomy, disclosed the following: The uterus was enlarged to the size of a two months' pregnancy, with definite tenderness over the fundus; however, similar tenderness could also be elicited over the entire abdomen except in the region of the adnexa. Putting the broad ligament on tension, by moving the cervix from side to side, produced no symptoms. Bulging in Douglas' pouch was not noted either by vagina or rectum.

Urinalysis was negative. The blood showed 87 per cent Hb. (Sahli), 12.5 gm. Hb; 4,680,000 red blood cells and 8,400 white blood cells, with a normal differential count. Clearly the picture at this time was that of generalized peritoneal irritation, complicating a normal intrauterine pregnancy, with the gall bladder as the possible pathologic focus.

The lower bowel was cleansed by enema after two unsuccessful attempts. It is significant that the patient at this time fainted when she made an effort to leave her bed. However, her pain was considerably relieved and she had a restful night. The next day all the symptoms returned with greater intensity. She was then admitted to the hospital, four days after the onset of pain.

On admission, her temperature was 99° F., pulse 110, and blood pressure 120/65. The only change in the appearance of the patient, as noted several hours after admission, was a marked pallor. Sedimentation time was 31.5 mm. A flat plate of the abdomen showed a diffuse uniform haziness, not increased in depth over the lower abdomen. This was interpreted by the roentgenologist as being caused by the patient's marked obesity. Her blood count, however, showed a significant change: Hb. 50 per cent (Sahli), 7.3 gm. Hb.; 2,550,000 red blood cells, and 7,000 white blood cells, with a normal differential count. Both counts were done by the same technician.

On the basis of the second blood count and the change in the patient's appearance, a diagnosis of a ruptured ectopic pregnancy was made and immediate section

*Presented at a meeting of the Obstetrical Society of Philadelphia, October 5, 1939.

done. The abdominal cavity was filled with blood. The right tube was markedly enlarged, showing a rupture in the isthmial portion. The contiguous ovary was attached to the tube. The uterus was soft and was about the size of a two months' pregnancy. The left tube and ovary appeared normal. No corpus luteum was seen on the surface of the left ovary. A right salpingo-oophorectomy was done, a blood transfusion was given when the operation was completed and the patient was returned to her room. Within four days postoperatively she had a spontaneous abortion. She made an uneventful recovery.

Pathologic Findings.—"The specimen consisted of the right Fallopian tube and ovary. The ovary contained two corpora lutea, one measuring 2 cm. and the other 1 cm. The tube was greatly enlarged measuring 6 by 3 by 3 cm. At one region on its surface was a ragged hemorrhagic area probably representing the site of rupture and hemorrhage. Within the tube was a cystic area containing a tiny fetus, 1 cm. in length and to which was attached an umbilical cord. The wall of the contiguous tubal tissue was deeply hemorrhagic.

"In the hemorrhagic portions of the tube were many well-preserved chorionic villi. The cells of the larger of the two corpora lutea were large as is seen in the corpus luteum of pregnancy. A few cells of the smaller of the corpora lutea were also large, but the great bulk were of smaller dimensions.

"Microscopic examination of the tissue expelled from the vagina on 1-13-39, four days after the laparotomy, showed, in addition to much degenerated decidua and chorionic villi, many well-preserved chorionic villi."

Several months after discharge, the following noteworthy addition to the history was made by the patient, namely: that the abdominal pain started after she was kicked in the abdomen. However, had this fact been known it would only have added confusion to an already bizarre picture.

REFERENCES

(1) *Dolan, E. J.:* J. A. M. A. **110**: 1438, 1938. (2) *Neugebauer:* Wien. Klin. Wchnschr. 1907; also, Gynäk. Rundschau **7**: 809, 1913. (3) *Novak, Emil:* Surg. Gynec. Obst. **43**: 26, 1926.

OVARIAN PREGNANCY*

THEODORE H. GRUNDFAST, M.D., AND
SAMUEL B. SCHENCK, M.D., F.A.C.S., BROOKLYN, N. Y.
(From the Department of Gynecology of the Jewish Hospital)

MRS. L. E., 31 years of age, was admitted to the service of Drs. Schwartz and Schenck at the Jewish Hospital at 2 A.M. on Oct. 22, 1938, complaining of acute abdominal pain of eight hours' duration. During this time she had several fainting spells and also complained of marked thirst and weakness. She had three previous miscarriages and three normal deliveries, her last pregnancy terminating in a living normal child born ten months before admission. She had a twenty-eight day menstrual cycle, her last normal period having occurred on August 25. She stated that she skipped her September period and took quinine, after which she bled on October 2, one week overdue. On the afternoon prior to admission, after coitus, she was seized with severe abdominal pain, weakness and fainting spells. For the preceding two weeks she had noticed fullness of the breasts.

Physical Examination.—The patient was pale, restless, and had air hunger; pulse was 120, poor volume; blood pressure was 80/60, temperature 101.4° F., respirations 40. The abdomen was distended. There was marked tenderness and rebound tenderness over the entire abdomen but especially in the right lower quadrant. The

*Presented at a meeting of the Brooklyn Gynecological Society, October 6, 1939.

right rectus was spastic. There was no vaginal bleeding; the uterus was softened, slightly enlarged. The cervix was soft and tender on motion. There was a definite fullness in the posterior and both lateral fornices. Urinalysis was negative. Blood count showed 4,100,000 red blood cells, hemoglobin 70 per cent, 19,000 white blood cells with 80 per cent polymorphonuclears. A diagnosis of ruptured ectopic pregnancy was made, and while waiting, the patient was given morphine, placed in Trendelenburg position, given applications of external heat and prepared for blood transfusion.

Fig. 1.—Photomicrograph (×80) showing chorionic villi, hemorrhage, islands of decidual cells, and in the upper right hand corner, bordering islands of lutein cells.

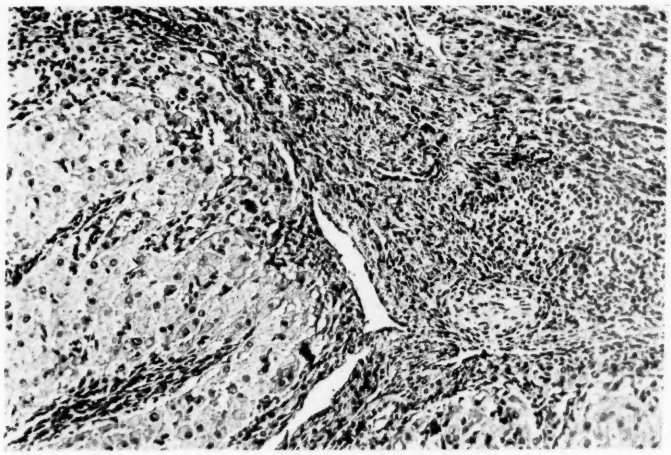

Fig. 2.—Photomicrograph (×200) showing higher power of the corpus luteum previously described, with detailed structure of lutein cells.

Operation.—Under nitrous oxide and oxygen anesthesia, a midline incision was made in the lower abdomen, and the peritoneal cavity was found to be filled with free and clotted blood. Both tubes and the left ovary were normal. The right ovary was found to be the seat of a recently ruptured cyst, containing a blood clot at its lateral pole. A right salpingo-oophorectomy was performed. The abdomen was closed without drainage and a blood transfusion of 500 c.c. of citrated blood was administered while the abdomen was being closed.

Postoperative Course.—The patient's condition improved immediately after operation, and she made an uneventful recovery. She was discharged on Nov. 5, 1938, on the fourteenth day after operation.

Pathologic Report.—Gross: The specimen consisted of the right Fallopian tube measuring 8 by 0.4 cm. with the attached right ovary. The tube was normal and the fimbriated end patent. The ovary measured 4 by 3 by 2 cm. The external surface was yellow and gyrate and had a cystic hemorrhagic protrusion at one pole, measuring 1.5 cm. in diameter and filled with clotted blood. The cut surfaces of the ovary were gray streaked with brown and contained cystic areas up to 2 cm. in diameter filled with light brown material and surrounded by a thick yellow wavy rim.

Microscopic.—At one end of the specimen there was a broad lumen, containing old and more recently extravasated blood and strands of young fibroblasts. Scattered in the blood clots were well-formed chorionic villi with preserved Langhans and syncytial cells. Attached to some of the chorionic villi were sheets of decidual cells. Scattered within them were numerous syncytial giant cells. Part of the lumen was lined by a single row of flat cells resting on a normal band of hyalinized fibrous connective tissue and part of it lined by many rows of well-preserved, larger irregular lutein cells. Beyond this was a broad band of normal ovarian stroma with old and more recent corpora albicantes and small follicular cysts. In places syncytial giant cells were seen extruding into the corpus luteum that formed part of the wall of the lumen. A preparation from another corpus luteum that was seen grossly within the ovary showed an irregular lumen, containing old and more recently extravasated blood, and was lined by many rows of well-preserved lutein cells. These were irregular with abundant granular cytoplasm and large vesicular nuclei, and resembled in appearance cells noted in previous sections of corpus luteum. Bordering this was a band of ovarian stroma and old and more recent corpora albicantes and small and large follicular cysts. The microscopic sections of the right tube were normal and showed no trophoblastic elements.

Diagnosis.—Intrafollicular pregnancy of the right ovary with two corpora lutea of pregnancy.

We wish to thank Dr. David M. Grayzel for the careful pathologic studies.

3214 Clarendon Road
135 Eastern Parkway

Pinkert, M.: Treatment of Benign Uterine Hemorrhages in Women Over Forty With Special Consideration of Symptoms of Abolished Function, Arch. f. Gynäk. **168:** 209, 1939.

The author discusses the nature of uterine hemorrhages and the irregularity so frequently found in women past forty. He discusses also the symptoms of abolished function of the uterus and ovaries, emphasizing the severity of the symptoms which arise from roentgen castration or radium therapy. He emphasizes the absence of such symptoms when such a diseased uterus is removed surgically with preservation of the ovaries. He believes that vaginal hysterectomy is superior to irradiation castration because of the ability to maintain and continue ovarian function. The same is true for abdominal hysterectomy for larger tumors. Irradiation entails less risk and definitely lowers mortality and morbidity. In spite of this and in spite of the fact that the author was one of the first to use roentgen treatment for fibroids and metropathia, he now resorts to this form of treatment only occasionally and only for the specially selected case. He has definitely arrived at the conclusion that surgery is the method of choice in spite of the somewhat higher morbidity and mortality.

Ralph A. Reis.

A SIX-YEAR CURE OF CANCER OF THE VULVA IN A TWENTY-TWO-YEAR-OLD PATIENT*

N. VOLNEY LUDWICK, M.D., PHILADELPHIA, PA.
(From the Tumor Clinic, Hahnemann Hospital)

CARCINOMA of the vulva is characteristically a cancer of elderly women. In reporting this case, I wish to emphasize two salient and important features, namely, the age when first seen, 22 years, and second, that she is now alive and well, six years after her original admission.

In reviewing the literature on this subject, one is impressed by these two facts, of age incidence and high mortality, particularly in younger individuals.

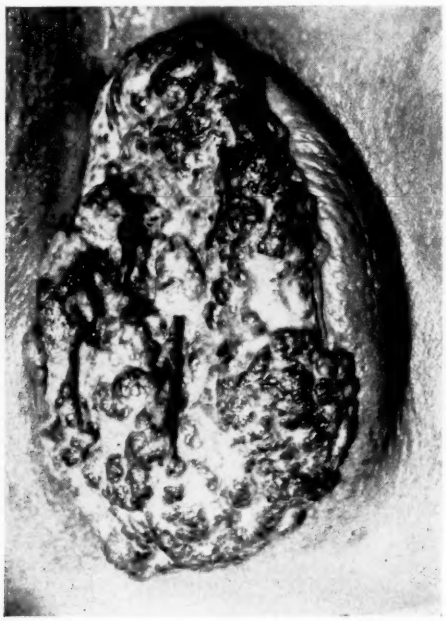

Fig. 1.—Photograph (close-up) taken upon admission (July 12, 1933).

Taussig in one report gives the average age incidence of cancer of the vulva as 59 years, and another report by the same author, states that 60 per cent of the patients are over 60 years, and 30 per cent are over 70 years. Schrimer and Wehr reported 118 cases, the youngest patient was 25 years.

I have been unable to find a report of a case of carcinoma of the vulva in one so young, who has remained alive and well after five years.

Patient, aged 22 years, was admitted to the Gynecological Ward of Hahnemann Hospital July 12, 1933, with a history of having a small pimple-like lesion on the right labia for several months, gradually increasing in size and ulcerating. This continued for about eight months, when immediate hospitalization was advised.

*Presented at a meeting of the Obstetrical Society of Philadelphia, October 5, 1939.

Upon admission she had a large cauliflower mass of the vulva involving the labia on both sides, with apparent adenopathy in both inguinal areas (Fig. 1).

A complete vulvectomy, by electrothermic removal, was performed, followed immediately by radium application over each inguinal region. Two weeks later

Fig. 2.—Photomicrograph of section of tumor taken from margin, showing normal overlying skin with invading margin of tumor beneath. (×30.)

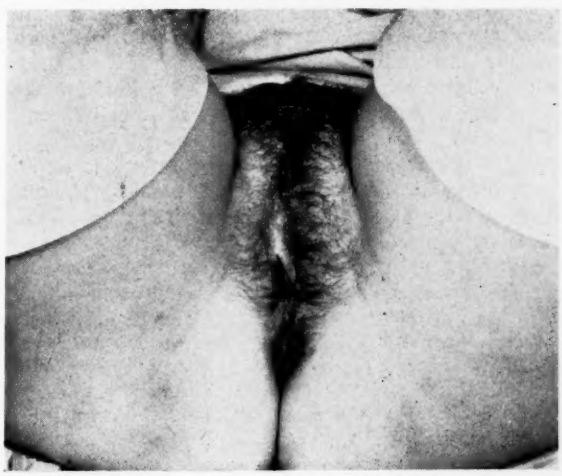

Fig. 3.—Photograph taken July, 1939. No evidence of recurrence.

a second series of radium exposures was given directly over the operative field. Deep x-ray therapy was instituted at once and continued regularly for about one year.

The total radium exposure amounted to 1,270 mg. hours, a relatively small dose and her x-ray therapy, given from Aug. 11, 1933, to Dec. 17, 1934, totaled 6,000 roentgen units through five portals of entry.

Correspondence

Conservative Obstetrics

NOTE: We are pleased to publish the following letter as illustrative of the good results of the teaching of conservatism in obstetrics in our medical schools. The writer's conviction that a satisfactory outcome in adequately managed cases is to be expected, is worthy of attention and emulation.

To the Editor:

There has been considerable criticism in recent medical literature of the manner in which the modern physician conducts his obstetric cases. Putting it specifically, I quote from a recently published letter, in which the author accuses the modern physician of "altogether too much meddlesome midwifery."

Having graduated from a Class A medical school within the last four years I consider myself a modern physician. Although I am a general practitioner and have had no special training in obstetrics, other than that prompted by study, because this particular field of medicine appeals to me, I have had exceptionally good results. I attribute this to the application of the conservative methods taught me in medical school.

During my first two years in practice I attended 208 obstetric patients. About 75 per cent were cared for at home and the majority of these under very adverse circumstances with no professional assistance of any kind. I had no maternal deaths and not one patient had either a post-partum infection or hemorrhage. In 8 per cent of this series I encountered complications at delivery. These included a placenta previa in a primipara, 3 eclamptics and several pre-eclamptics, 4 breech presentations, a toxic jaundice of pregnancy, a retained placenta, necessitating manual removal seven hours after delivery, a syphilitic, a gravida iv with a severe mitral stenosis on the verge of decompensation, two pair of twins, one contracted pelvis that necessitated a cesarean section, 4 occiput posteriors that rotated and delivered spontaneously, and several cases in which labor was prolonged. These latter patients delivered without undue hardship because of repeated rest periods induced by the judicious use of morphine. Instruments were used in only two cases: one, the cardiac, whom I delivered with forceps under perineal block anesthesia as soon as she was completely dilated; the other, a patient that developed a maniacal psychosis soon after the onset of labor. Many of these patients had no prenatal care whatsoever.

In addition to the above obstetric cases, I operated upon two ectopic pregnancies and cared for several patients suffering from hemorrhage or infection or both following crudely induced abortions. There were no fatalities in this group.

My infant and fetal mortality combined was 3.8 per cent. This included 3 of 11 premature infants, 2 stillborn babies from eclamptic mothers, 1 stillborn syphilitic, 1 breech which had precipitated except the head and was dead when I arrived, and 1 apparently normal infant whose heart was beating after a normal and spontaneous birth, but who failed to breathe. Of the 8 premature infants that lived, one weighed only 3 pounds, another 3 pounds 6 ounces and, the remaining 6 less than 5 pounds at birth.

Nowadays with a large number of articles appearing in lay magazines exhorting the wonders of "twilight sleep" and "streamlined babies," it is becoming difficult to convince women that Nature's way is best. They forget to mention that soundproofed rooms and special nurses are essential to handle patients rendered uncooperative by the effects of the drugs and also the fact that these procedures cause

a sharp rise in the incidence of operative deliveries, maternal complications, and infant mortality. I am firmly convinced that a bit of humor along with encouragement when the going is tough is more beneficial and far less harmful than all the analgesic drugs now advocated for obstetric use.

In order to illustrate my point I will review the following case. One of the town's young matrons came storming into my office demanding an abortion. I finally convinced her to accept her condition, and she continued to come to me for prenatal care. As term approached she became very apprehensive and finally announced that she was going to have a cesarean section and have her tubes tied at the same time. I informed her that I was the one who determined the necessity of such procedures and that if she insisted upon it she would have to find another physician who would concede to her demands. Unfortunately she went three weeks past term in spite of several conservative attempts to start labor. She had a large baby in a right occipitoposterior position, and labor was prolonged. Twice during labor I gave her morphine which allowed her much needed periods of rest. No other sedatives or analgesics were used except nitrous oxide during the final stage of labor. The patient was very cooperative and never once made an outcry that could be heard in the hallway. The head rotated and the baby was born spontaneously. The patient was bright and cheerful the next day and stated that she did not think labor was half as bad as she had anticipated. They are now considering an addition to their family.

Although this series of cases is not large I believe the results were good, taking into consideration the number and type of complications, the lack of facilities for delivery, and the fact that a goodly number of these cases were primiparas who had had no prenatal care. By extreme patience and conservative handling I have encouraged many a mother on to a normal delivery where others would have interfered. I have been able to do this by retaining the confidence and cooperation of the patient. Patients readily sense any hesitancy on the part of the obstetrician, due to lack of confidence in himself, during prolonged labors or under trying circumstances. With loss of faith goes loss of courage on the part of both physician and patient. The former then feels forced to choose the most rapid and convenient method of getting things over with as soon as possible.

The day of elective radical procedures in obstetrics is rapidly fading and the pendulum is swinging back to conservative methods. Statistics bear this out. At the present time our state (Minnesota) boasts one of the lowest maternal death rates in the country. This is no doubt due to the fact that our medical school stresses conservatism in obstetrics, and for the men already in practice, the State Board of Health sponsors postgraduate lectures on obstetrics at various points throughout the state each year.

PAUL C. BENTON, M.D.

GIBBON, MINN.

To the Editor:

The ensuing is a follow-up note on a case of "Sarcoma of the Uterus Complicating Pregnancy" which was reported in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, 26: 457, 1933.

At this writing, more than nine years after the operation, the patient is alive and well. There are no metastases or recurrence. She has since been delivered of another child. In view of this history, it was thought that the original pathologic diagnosis may have been incorrect. The slides were then presented to the Tumor Conference of the Caledonian Hospital (Dr. W. Hala, Pathologist), and the original diagnosis reaffirmed. The slides were then taken by Dr. Hala to Dr. James Ewing, who confirmed the diagnosis. As far as I can find, this is the only published instance of its kind.

MAURICE G. DERBRUCKE, M.D.

January 18, 1940
471 Park Avenue
Brooklyn, N. Y.

Society Transactions

CENTRAL ASSOCIATION OF OBSTETRICIANS AND GYNECOLOGISTS

Eleventh Annual Meeting, Kansas City, Mo.
November 2, 3 and 4, 1939

The following papers were presented:

Presidential Address: "James Henry Bennett, the Forgotten Man." Dr. Ralph A. Reis, Chicago, Ill.

A Study of the Possible Significance of the Vaginal Smear as an Additional Factor in the Diagnosis of Incomplete Abortion. Dr. Paul F. Fletcher, St. Louis, Mo. (For original article, see page 562.)

The Management and Treatment of Habitual Abortion. Dr. Ralph E. Campbell and Dr. Elmer L. Sevringhaus, Madison, Wis. (For original article, see page 573.)

Intrauterine Death of the Fetus After the Twenty-eighth Week. Drs. Henry Buxbaum and I. C. Udesky, Chicago, Ill. (For original article, see page 659.)

Limitation of Human Reproduction. Drs. H. C. Hesseltine, F. L. Adair, and M. W. Boynton, Chicago, Ill. (For original article, see page 549.)

Spontaneous Pneumothorax of the Newborn Infant. Dr. Edwin J. DeCosta, Chicago, Ill. (For original article, see page 578.)

Post-partum Sterilization. Drs. H. P. Hewitt and J. R. Whitley, Chattanooga, Tenn. (For original article, see page 649.)

Post-partum Labial or Paravaginal Hematomas. Dr. H. G. Hamilton, Kansas City, Mo. (For original article, see page 642.)

Transverse Abdominal Incisions in Pelvic Surgery. Dr. G. Wilson Hunter, Fargo, N. D. (For original article, see page 593.)

Report of the Committee on Clinical Affairs: Chronic Cervicitis. Dr. N. R. Kretzschmer, Chairman, Ann Arbor, Mich. (For original article, see page 665.)

Upon Certain Medical Philosophies. Dr. Edward A. Schumann, Philadelphia, Pa.

Granuloma Inguinale (Granuloma Venereum) of the Cervix. Drs. R. E. Arnell, New Orleans, La., and J. S. Potekin, Chicago, Ill. (For original article, see page 626.)

Further Studies on the Androgen Therapy of Gynecologic Disorders. Dr. J. P. Greenhill, and S. C. Freed, Chicago, Ill. (For original article see page 636.)

The Treatment of Bacteriemias With Sulfanilamide. Dr. J. R. Reinberger, Memphis, Tenn. (For original article, see page 618.)

Scarlet Fever in Obstetrics. Dr. A. W. Diddle, Ray E. Trussell and Dr. E. D. Plass, Iowa City, Iowa. (For original article, see page 608.)

The Induction of Labor With Small Doses of Powdered Ergot. Drs. C. J. Ehrenberg, O. F. Robbins and John A. Haugen, Minneapolis, Minn. (For original article, see page 653.)

Fat Metabolism in Pregnancy. Dr. Otto Schwarz, St. Louis, Mo.

The Newborn Infant. Dr. Thomas J. Sims, Kansas City, Kan.

OBSTETRICAL SOCIETY OF PHILADELPHIA

MEETING OF OCTOBER 5, 1939

The following case reports and papers were presented:

A Six-Year Cure of Cancer of the Vulva in a Twenty-Two-Year-Old Patient. Dr. N. V. Ludwick. (For original article, see page 716.)

Simultaneous Extra- and Intrauterine Pregnancy. Drs. Benjamin Leff and David R. Meranze. (For original article, see page 712.)

Experiences With a Placental Blood Bank. Dr. W. M. Heyl. (For original article, see page 679.)

Intermenstrual Pain—A Surgical Condition. Dr. E. F. McLaughlin. (For original article, see page 684.)

MEETING OF NOVEMBER 2, 1939

The following paper was presented:

Roentgen Pelvimetry. Dr. Herbert Thoms. (By invitation.)

CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF OCTOBER 20, 1939

The following case reports and papers were presented:

Two Cases of Brenner Tumor. Dr. W. C. Danforth and Dr. H. J. Holloway (by invitation).

Transperitoneal Approach in the Management of Inaccessible Vesicovaginal Fistulas. Dr. W. C. Danforth. (For original article, see page 690.)

Focal Infections in Pregnancy. Drs. Tom D. Paul and Charles E. Galloway. (For original article, see page 694.)

Premature Infant Mortality. Drs. Robert M. Grier and Herbert O. Lussky. (For original article, see page 669.)

Bipartite Uterus. Drs. E. L. Benjamin and W. C. Danforth. (For original article, see page 704.)

BROOKLYN GYNECOLOGICAL SOCIETY

MEETING OF OCTOBER 6, 1939

The following papers were presented:

Full-Term Pregnancy Complicating Carcinoma of the Cervix. Drs. Isidore Daichman and E. M. Wilder. (For original article, see page 709.)

Ovarian Pregnancy. Drs. Theodore H. Grundfast and Samuel B. Schenck. (For original article, see page 713.)

Missed Labor. Dr. William Pomerance. (For original article, see page 698.)

Report of a Case of Tuberculous Endometritis. Dr. George Kornfeld.

Consideration on Rupture of the Uterus at Term. Drs. G. Kornfeld and H. J. Greene.

Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D.

Selected Abstracts

Endocrinology of Pregnancy

Klar, E.: Hormone Effect of the Ovum, Klin. Wchnschr. **18**: 600, 1939.

A substance was isolated from the ovum which produced abortion with great regularity in mice and rabbits. A similar effective substance was found in a series of cases in the urine of menstruating women, but this latter substance was not found with any degree of regularity. This substance which could not be completely isolated is believed to be a simple albumin. The author believes therefore that the dead ovum has a definite endocrine action.

RALPH A. REIS.

Hain, A. M.: Oestrogenic and Androgenic Substances in Pregnancy, Edinburgh M. J. **10**: 678, 1938.

The estrogenic substances, "the female hormones," are responsible for heat or estrus in female animals. They are also present in the male. The androgenic substances, "the male hormones," are probably present in large amounts in the nonpregnant woman. They are responsible for certain male characteristics and are secreted by the ovary, testis, and the adrenal.

Marked differences in hormone concentration exist between individuals. It is advisable to make more frequent estimation of the hormone concentration than at monthly intervals during pregnancy, and during the last ten days daily estimation would be likely to give valuable information. It seems that the upward trend in hormone concentration which occurs in the last month of pregnancy is preceded by a relatively low level. There is no indication that very high values of estrin are necessarily associated with labor either in the combined or free form. By far the greater portion of the estrogenic substance excreted in pregnancy is found in the form of estriol. The androgens do not bear any quantitative relationship to the estrogens but show a tendency to share in the general hormone decrease at the ninth month and in the rise during the last month of gestation. There is less androgenic substance excreted by the pregnant than by the nonpregnant woman.

WM. C. HENSKE.

Mühlbock, O.: Free and Combined Estrogens in the Blood During Pregnancy, Lancet **1**: 634, 1939.

From 29 to 50 per cent of the estrogenic substances present in the blood of the pregnant woman are in the combined form. It is necessary to extract the blood after hydrolysis in order to obtain the total estrogenic hormone content. In many previous studies this has not been done. In 5 cases studied by the author, the total estrogenic hormone content varied from 150 international units per liter in a case of eclampsia to 2,000 international units in a normal pregnancy. A second normal pregnancy showed 750 I.U. per liter and a toxemic patient showed 900 I.U.

CARL P. HUBER.

Smith, G. Van S., Smith, O. W., and Pincus, G.: Total Urinary Estrogen, Estrone and Estriol During Menstrual Cycle and Pregnancy, Am. J. Physiol. **121:** 98, 1938.

The writers comment on the "total" estrogenic potency of urine collected through a menstrual cycle and a pregnancy in a woman aged 27 years. The separation of theelin and theelol in the menstrual cycle revealed that (1) more theelin than theelol was present throughout, (2) more theelol was excreted during the luteal phase than during menstruation and excreted during the luteal phase than during menstruation and the period of follicle ripening, (3) a rise in theelin accompanied by the onset of menstruation, and (4) the theelin to theelol ratio was twice as high during the first two days of both catamenias followed as at any other time.

The separation of theelin and theelol through pregnancy revealed that (1) the only specimen which showed more activity in the theelin than in the theelol fraction was collected at the time of the second missed menstruation when the patient had been put to bed for flowing, (2) theelol was in the ascendancy for the rest of the pregnancy, its rate of increase being greater than that of theelin to the last month, (3) false labor twelve days before delivery was accompanied by a marked rise in both theelin and theelol, the ratio of the two remaining unchanged, and (4) in labor the rise in theelin was so great that the ratio of theelol to theelin was lower than it had been at any time since the second month. Comparison of colorimetric with bio-assay on the pregnancy urines from the fourth month on suggested the presence of some estrogen in addition to theelin and theelol and more active than either (estradiol).

J. P. GREENHILL.

Dingesmanse, E., Laqueur, E., and Mühlbock, O.: The Excretion of Estrogenic Hormone in the Urine of Pregnant Women, Monatschr. f. Geburtsh. u. Gynäk. **109:** 37, 1939.

The authors found that the amount of estrogenic hormone which is excreted during pregnancy varies considerably. The extremes are 15,000 and 80,000 international units per liter of urine during the first half of pregnancy. It was found that about 97 to 98 per cent of the estrogenic hormone in the urine is the combined form. However, in most cases just before the onset of labor, part of these hormones is excreted in the uncombined or free form so that only about 80 or 90 per cent is combined estrin. During labor the amount of hormone excreted may decrease markedly.

The proportion of keton (estron) combination to non-keton (estriol) combination is 1:1 to 2:3 and is dependent upon the biologic effect during the last few months of pregnancy. During labor the proportions of the free fraction of estrin and the combined fraction change to 1:2 and 2:3, respectively. The proportion of keton to non-keton fraction in the urine of normal men and non-pregnant women is 1:1.

J. P. GREENHILL.

Parker, Frederic, Jr., and Tenney, Benjamin, Jr.: A Study of the Estrogenic Content of the Tissues in Pregnancy, Endocrinology **23:** 492, 1938.

In five cases maternal and fetal organs have been extracted and assayed for their estrogenic substances and titrated against the placental content. In addition, the organs of 6 fetuses have been titrated against their placentas. The livers and adrenals of both mother and fetus have been studied because of their known involvement in the cholesterol metabolism. The effect of decomposition of the tissues on the amount of the estrogens extracted has been studied. The results have led them to believe that the source of the estrogens during pregnancy is in the general cholesterol metabolism. Although the placenta plays a prominent part, it is not the actual source. The maternal liver and/or the fetal liver contain more estrogenic substance in pregnancy than the placenta. The

fetal adrenals contain as much as, or more than, the placenta. Decomposition of tissue causes an increase in amount recovered from the placenta and a decrease in the liver. The general cholesterol metabolism is a more likely source of the estrogenic substances in pregnancy than the placenta.

J. T. WITHERSPOON.

Jones, Howard W., and Weil, Paul G.: The Corpus Luteum Hormone in Early Pregnancy, J. A. M. A. **111**: 519, 1938.

In this case the corpus luteum of pregnancy was removed on the fifty-eighth day after the last menstrual period. Abortion did not take place. Following the operation, the daily urine content of pregnandiol, an excretion product of progesterone, was determined. For twelve days after the removal of the corpus luteum no pregnandiol was present in the urine. It then reappeared in increasing amounts. This seems to indicate that in the human being pregnancy can survive after the withdrawal of progesterone or that it can survive on amounts too minute to be determined by the method employed. Progesterone is probably produced by the placenta at about the end of the second month. Pregnandiol disappears from the urine within twenty-four to forty-eight hours after delivery, which would suggest that progesterone is produced in the placenta.

GROVER LIESE.

Gillman, J., and Smyth, G. S.: The Hormonal Content of the Human Luteal Follicle of Pregnancy as Determined by Its Effect on the Perineum of the Baboon, South African J. M. Sc. 4: 36, 1939.

Research in experimental physiology conducted by the authors has revealed some facts that are valuable as well as interesting. The hormonal content of human pregnancy corpus luteum was demonstrated by observing its effect upon the perineum of four mature baboons, all of which had menstrual or perineal cycles of known and equal duration (thirty-eight days). Comparison was made with the result of injection in the same animals of an oil emulsion of whole corpus luteum, and a commercial preparation of progesterone (proluton).

Human corpora lutea of early pregnancy are cystic and contain up to 1.5 c.c. of straw-colored fluid which possesses considerable potency. Those employed in this experiment were of a calculated maximum age of from sixty-three to seventy-seven days. Small measured amounts of the luteal fluid (1.0 c.c.; 0.5 c.c.; 0.25 c.c.) were injected into the baboons during the first or turgescent part of their menstrual cycle. The effects were compared with those obtained following injection of an emulsion in oil of whole corpus luteum, and progesterone substance (proluton). In general, both the luteal fluid and the preparation of progesterone had a similar qualitative effect, in that they caused perineal deturgescence when administered in a single dose early in the cycle. They differed, however, in the time factor of the physiologic response; progesterone being twice as rapid and not lasting long, while the luteal fluid was slower but had a more protracted action. Furthermore the luteal follicular substance definitely shortened the menstrual cycle, unlike single progesterone injections which lengthened the cycle. The series of perineal changes in the cycles experimentally induced by luteal fluid were quite similar to those observed in the second half of normal perineal (menstrual) cycles.

A number of conclusions were drawn from these and other experiments:

1. The fluid removed from the human corpus luteum of early pregnancy is not the same substance generally known as progesterone, having a different action and being more potent.

2. The luteal fluid is suspected to contain a hormone or hormones, hitherto unrecognized, elaborated by the corpus luteum. This is probably a potent gonadotropic factor for the existence of which direct evidence has been obtained from collateral experimental work on the rabbit.

3. Crude extracts (oil emulsion) of whole corpus luteum did not affect either the perineum or the length of the cycle.

4. What is known as progesterone probably represents only a part of the hormonal complex.

No mention is made of the method by which these corpora lutea were obtained.

ARNOLD GOLDBERGER.

Hain, A. M., and Robertson, E. M.: Estimation of Luteal Activity and Early Diagnosis of Pregnancy, Lancet **1**: 1324, 1939.

The possibility of using quantitative determinations of pregnandiol as a diagnostic test for pregnancy is illustrated by a case report. During routine investigation of a patient for habitual abortion, an excretion of 15 mg. pregnandiol per day on the twentieth to twenty-fourth days of the cycle led to the suspicion of pregnancy. This patient had excreted 114 mg. of pregnandiol from the twelfth to the twenty-fourth days of the cycle, while in the nonpregnant the range of excretion values is up to 60 mg. during this period of time. The Aschheim-Zondek test was negative on the twenty-eighth day of the cycle but became positive on the thirty-third day. A diagnosis of pregnancy was made one day before the menstrual period was missed.

CARL P. HUBER.

Lazarus-Barlow, P.: The Friedman Test in Hydatidiform Mole and Chorionepithelioma, Brit. M. J. **1**: 71, 1937.

Four cases are reported in which the forty-eight-hour Friedman test proved valuable in diagnosis of hydatid mole and chorionepithelioma, following abortion in 3 cases and an abnormal pregnancy in one. The test reveals early the case of hydatid mole that passes on to chorionepithelioma.

The test is valuable in confirming complete removal of a mole and in disproving any pathologic significance of existing discharges. It serves to prove the absence of any secondary growths after removal of a chorionepithelioma.

F. L. ADAIR AND S. A. PEARL.

Keller, R., and Limpach, J.: Apparently Contradictory Results in the Biologic Test for Pregnancy Noted in a Case of Chorionepithelioma, Gynéc. et obst. **37**: 168, 1938.

The occurrence of several negative biologic tests for pregnancy in a patient upon whom the diagnosis of chorionepithelioma was made by histologic examination and proved by the susequent clinical course forms the basis of this interesting report.

A curettage had been done followed six days later by a hysterectomy. The chronologic sequence and the results of the biologic tests were as follows: (1) Negative: eight days after curettage and two days after operation. Rabbit injected with 1/12 c.c. of urine. (2) Negative: thirteen days after curettage and seven days after operation. Rabbit injected with 60 c.c. of urine. (3) Doubtful reactions in several rabbits fourteen days after curettage, and eight days after operation. (4) Definite positive reaction with controls twenty-four days after curettage and eighteen days after operation.

The patient was discharged on her twenty-sixth postoperative day in good condition, with no x-ray evidence of pulmonary metastases, and the vagina clear. Within a month signs of "pleurisy" developed, and examination disclosed metastatic foci of chorionepithelioma. Her death occurred approximately fourteen weeks after her admission to the hospital.

Several possible explanations are offered for the apparent contradiction between the results of the biologic test and the histologic characteristics of the tissue obtained by curettage. The thorough curettage removed almost the entire lesion which from the beginning was probably a chorionepithelioma that had not spread beyond the limits of the uterine cavity. Except for the microscopic disclosure of a minute thrombus formed by a group of syncytial cells, the excised

uterus revealed no evidence of chorionic tissue. This is evidence that dissemination of tumor cells probably occurred at the time of curettage. The abrupt removal of practically the entire lesion by hysterectomy was followed by a lowering of the concentration of the gonadotropic hormone to the extent even of its complete disappearance from the blood stream (''negative phase''). This explains the first two negative biologic tests. The doubtful test which developed on the fourteenth day after curettement, and the positive tests which developed on the twenty-fifth and twenty-seventh days were probably due to the gonadotropic hormone elaborated by chorionepitheliomatous cells which entered the circulation and proliferated, having been disseminated at the time of curettage. This rapid increase in the blood concentration of hormone paralleled the equally speedy clinical course. It is possible that the concentration of gonadotropic principle in the blood might vary under the influence of factors yet unknown, for it has been shown that the hormonal concentration varies even in normal gestation. Support for this theory may be found in the fact that some portions of the tumor may be growing rapidly, while others are degenerating. Some of the metastases may become necrotic. Essentially, the quantity of gonadotropic hormones fluctuates and depends upon the vigor and the abundance of the chorionic elements by which it is elaborated.

In certain instances an apparent cure has been effected by the development of a dense proliferation of fibrous tissue about chorionepithelial foci sufficient to isolate them and prevent their hormonal secretion from entering the circulation. Should the syncytial elements outgrow the mesoblastic barrier, hormonal secretion may continue.

From an appreciation of the factors mentioned, the authors emphasize the fact that the occurrence of certain unexpected or paradoxical reactions in the biologic test for pregnancy does not detract from its usefulness and dependability. It continues to be of value in the diagnosis of chorionepithelioma, and especially in its control and prognosis.

ARNOLD GOLDBERGER.

Heiberg, Borge: Positive Friedman Reaction in a Case of Corpus Luteum Cyst, Acta obst. et gynec. Scandinav. **19**: 176, 1939.

Felding and Neergaard demonstrated that a positive Friedman reaction may be found in patients having dermoid cysts of the ovary. As is evident from a case reported by Heiberg and from a few cases collected by him from literature, there is one more group of ovarian cysts, in the presence of which the urine of the patient may give a positive Friedman reaction, namely a corpus luteum cyst.

The case reported by Heiberg emphasizes three different observations that have been made before, namely: the similarity between the clinical features of corpus luteum cysts and extrauterine pregnancy, the occurrence of a positive Friedman reaction in patients with corpus luteum cysts, and occasionally changes in the pituitary in patients with corpus luteum cysts.

J. P. GREENHILL.

Schurger, S.: Can the Results of the Induction of Labor Be Improved by Estrin, Zentralbl. f. Gynäk. **63**: 207, 1939.

Medical induction of labor is successful in only 50 per cent of cases. Schurger sought to increase this incidence by the addition of hormones. It is known that toward the end of pregnancy the amount of gonadotropic hormone gradually decreases, whereas the amount of estrin increases. Estrin increases the sensitivity of the uterus to pituitary hormone. A number of authors have reported that large amounts of estrin helped to stimulate labor pains in cases of uterine atony. Schurger used estrin in association with the Stein method of inducing labor. He gave castor oil and estrin in the early morning. Four hours later he administered thymophysin. Usually pains began within ten hours. By this combination he was able to increase the incidence of success in inducing labor to 80 per cent.

J. P. GREENHILL.

Cambon and Plasse: Estrin and Induction of Labor, Bull. Soc. d'obst. et de gynéc. **27**: 466, 1938.

The authors report their results in attempting to induce labor with estrin in 21 cases. The patients were given 10,000 units daily for three days. If labor did not start, the patients were given quinine and pituitary extract. There were 8 primiparas and 13 multiparas. Labor was induced in only 2 of the 8 primiparas and only three times among the 13 multiparas. In 5 additional multiparas, quinine and pituitary extract succeeded in starting labor pains.

J. P. GREENHILL.

Heckel, George P., and Allen, Willard M.: Maintenance of the Corpus Luteum and Inhibition of Parturition in the Rabbit by Injection of Estrogenic Hormone, Endocrinology **24**: 137, 1939.

Parturition in the rabbit is delayed by the continued injection of estrogenic hormone in the latter part of pregnancy. The ovaries must be present for this result to be obtained. In animals in which delivery has been postponed by this means, the corpora lutea are maintained and their continued activity is shown to be the cause for the delay in parturition.

Parturition is not delayed if injections of estrogen are not continued. Isolated injections in the latter part of pregnancy are followed by delivery of dead fetuses within four days. Under these circumstances the corpora lutea are not maintained. Cells of such corpora, by actual measurement, are smaller than those from corpora of normal pregnancy or from animals in which fetuses have been killed by estrogenic hormone but in which delivery has not occurred because of continuation of the injections. Doses of estrogenic hormone sufficient to delay parturition always cause death of the fetuses. A single injection on the twenty-seventh, twenty-eighth, or twenty-ninth day of pregnancy usually results in death of the fetuses within twenty-seven hours.

J. THORNWELL WITHERSPOON.

Tsutsulopulos: Sex Hormone and Intestinal Activity With Special Reference to Atony of the Intestines During Pregnancy, Arch. f. Gynäk. **168**: 608, 1939.

Disturbances of intestinal function during pregnancy may be due to changes in the glands of internal secretion, alterations in the ion concentration, lack of vitamins, abnormal metabolic processes, constitutional and psychic changes, and also the activity of the sex hormones.

The author studied the effect of the sex hormones on the intestinal activity of rabbits. He found that pituitary extract stimulates the tonicity and peristalsis of both the large and small intestines. Estrin, likewise, augments the tonicity of the large intestines when given in large doses over a long period of time. Progestin and prolan when given over a long period of time diminish the tonicity of the large intestines and make this structure refractory to the effects of pituitary extract. Prolan, however, has no effect in castrated rabbits. The effect of anterior pituitary hormone on the rabbit's intestines is uncertain.

J. P. GREENHILL.

Friedrich: Hormone Treatment of Pruritus Vulvae During Pregnancy, Zentralbl. f. Gynäk. **62**: 1289, 1938.

Pruritus vulvae in the climacterium can readily be overcome by means of estrin. It occurred to Friedrich that the same kind of therapy could be employed successfully for pruritus of the vulva during pregnancy. Theoretically, it is illogical to give a pregnant woman estrin because during gestation there is a very large amount of estrin in the circulating blood and in the urine. It would appear particularly inadvisable to give estrin during pregnancy because large doses of estrin sensitize the pregnant uterus to contract. The investigations of Cohen,

Marian, and Watson cleared up this problem by showing that 99 per cent of the estrin which is excreted in the urine is physiologically inactive.

Friedrich treated two pregnant women who had pruritus vulvae with estrin, and the patients obtained prompt relief. No harm was observed. The patients at first received 20,000 international units hypodermically three times a week. After relief was obtained, only two injections a week were given.

J. P. GREENHILL.

Fana, Camillo: Experimental Research on the Endocrine Function of the Mammary Gland, Folia gynaec. **25**: 419, 1938.

The author claims that in experimental animals the extract of mammary gland has shown an endocrine activity bringing on estrus and inducing a decided atrophy in the utero-ovarian region, but only in the presence of ovaries. He feels that the hypophysis is primarily stimulated and this, in turn, stimulates the ovary. In conclusion, the author states that the extract of the mammary gland gives good therapeutic results in any condition where an ischemia of the utero-ovarian region is desired, such as, menorrhagia, uterine fibromas, subinvolution of the post-partum uterus, etc.

MARIO A. CASTALLO.

Hoffmann, F.: The Effect of Estrin on the Histologic Structure of the Human Breast, Zentralbl. f. Gynäk. **63**: 422, 1939.

For the first time, Hoffmann studied the effect of large doses of estrin on the histologic structure of the human breast. He obtained the tissue while performing plastic operations on the breasts. In a woman past the menopause, 50,000 estradiol benzoate units were given. The breast showed an increase in the milk ducts and a marked hyperemia. These changes are identical with those observed in castrated animals after the administration of estrin. In a second case, a woman in the reproductive age, a total of 250,000 units were given. The breast tissue was removed on the twenty-third day of the cycle and showed an increase in the milk ducts, an increase in the alveolar tissue, and extreme hyperemia and edema.

These results indicate that even with relatively small doses of estrin, morphologic changes may be brought about in the human breasts. They also show that, analogous to animal experiments, estrin affects the milk duct system, whereas the corpus luteum hormone in association with estrin controls the alveolar system. These results support the belief that until puberty the human breasts are only a milk duct organ and that only with the development of corpora lutea does the alveolar system begin to function.

Therapeutically the author advocates estrin to stop the secretion of milk, especially in cases of milk fistula after incisions for infection. In cases of breast abscess as well as in plastic operations on the breasts, estrin may help wound healing by its power of inducing hyperemia and stimulating growth of tissue.

J. P. GREENHILL.

Preissenker: Hormonally Induced Asymmetric Swelling of the Breasts Before Puberty, Zentralbl. f. Gynäk. **63**: 451, 1939.

The author reports the case of a nine-year-old girl who received 35,000 international units of estrin because of gonorrheal vulvovaginitis. Shortly after this a painful lump developed in the right breast. With this there was excessive vomiting. Because of this combination of symptoms, corpus luteum hormone was administered to overcome the effects of the estrin. As a result of this therapy, all the disagreeable symptoms subsided. In three other girls treated with estrin before puberty, the author observed asymmetric breast swellings. Histologic studies were, of course, not made. On the other hand, in a 35-year-old woman, an adenoma was removed. This tumor developed a few weeks after 550,000 units of estrin had been given to overcome amenorrhea. Hence, estrin

may produce not only a hypertrophy of the uterine endometrium but also hypertrophy of the glands of the breast. The effects of excessive estrin stimulation are identical in the mature woman and in the prepubertal girl.

J. P. GREENHILL.

Fredrikson, Herbert: Endocrine Factors Involved in the Development and Function of the Mammary Glands of Female Rabbits, Acta ost. et gynec. Scandinav. **19**: 1, 1939.

Experiments were carried out by Fredrikson on hypophysectomized and ovariectomized animals. In the absence of the pituitary, development of the structures of the mammary gland corresponding to that found in animals which were not hypophysectomized was obtained with follicular plus corpus luteum hormone. But little colostrum was secreted in these cases. The action exerted by the ovarian hormones on the mammary gland must be direct and not dependent upon the collaboration of the hypophyseal hormones.

The author's experiments show that, when the pituitary is removed, the mammary gland undergoes a development which is directly due to the animal's own corpora lutea.

The author's experiments also revealed that prolactin acts as a strong stimulant on the secretion of milk in castrated but not hypophysectomized animals in which the mammary glands have been developed by injections of follicular hormone plus corpus luteum hormone, and that the doses used had no gonadotropic, thyrotropic or adrenotropic activity.

In addition, prolactin was given to rabbits hypophysectomized toward the end of normal pregnancy or during lactation, the first injection being given four to forty days after the operation. In all the cases, milk was secreted within four days, even in mammary glands which had undergone pronounced involution, resulting from hypophysectomy during pregnancy or lactation. The secretion ceased a few days after the last injection of prolactin.

J. P. GREENHILL.

Adrian, J.: Therapeutic Value of Injections of Estrogen in Undesirable Lacteal Production, Gynéc. et obst. **37**: 178, 1938.

Adrian resorted to treatment with estrogen, with the exclusion of all other therapeutic measures, in all cases in which an inhibition of the mammary secretion was justified, as in pulmonary tuberculosis, cardiac defects of the mother, stillbirth or early death of the infant. In some cases three injections of 20,000 international units are required; in other cases a single injection of this quantity is sufficient. This treatment proved successful in 57 per cent of 100 cases. In the other 43 per cent the results were insufficient, in that the secretion with expression of the breast persisted after the treatment. However, the result was nevertheless considerable in that the painful tension in the breasts, as well as the spontaneous secretion, ceased.

J. P. GREENHILL.

Kurzrok, Raphael, and O'Connell, Clinton Paul: The Inhibition of Lactation During the Puerperium by Testosterone Propionate, Endocrinology **23**: 476, 1938.

Twenty-one cases of early lactation during the puerperium were treated with testosterone propionate, for the purpose of inhibiting lactation. Usually the inhibition of lactation by the generally used therapeutic measures, and especially in their absence, is associated with pain, tenderness, engorgement, and lumpiness of the breasts. Such breast symptoms require considerable nursing care and are very distressing to the patient. Testosterone propionate in doses of 25 mg. usually relieves such symptoms in about twenty-four hours without the addition of any other therapeutic measures. The hormone is injected twice within forty-eight hours, although if complete relief occurs after the second or third dose, no

additional doses need be given. The puerperium was not otherwise affected by the hormone, and there were no unpleasant aftereffects.

J. T. WITHERSPOON.

Foss, G. L., and Phillips, P.: The Suppression of Lactation by Oral Oestrogen Therapy, Brit. M. J. 2: 887, 1938.

Sixty-two cases are reported in which oral administration of estrogen (progynon) gave consistently satisfactory results in suppression of lactation. Ideally, treatment should be started soon after delivery, giving doses of 5,000 I.U. twice daily for one to four days. Rapid softening of hard, swollen, congested breasts with almost immediate relief of discomfort is reported. It is thought possible that estrone acts specifically on the mammary gland, in some way preventing the action of the lactogenic hormone of the anterior pituitary, or even by a direct antagonism to this lactogenic hormone.

F. L. ADAIR AND T. G. GREADY.

Herold, L.: Morphologic Studies on Inhibiting Action of Estrogenic Hormone on Mammary Glands of Lactating Rats, Zentralbl. f. Gynäk. 62: 155, 1938.

The administration of small doses of estrogen to lactating rats results in a partial inhibition of milk secretion. Large doses produce complete suppression of lactation, especially if the large dose is given immediately after delivery of the litter. This inhibiting action of estrogen is not limited to the time of treatment but persists. Microscopically in the mammary glands of the lactating animals treated with estrogen, one observes closed glandular alveoli that are free from milk and have an epithelium-like covering. There is also evidence of lack of secretory processes in the epithelial cells.

J. P. GREENHILL.

Books Received

FETAL AND NEONATAL DEATH. By Edith L. Potter, M.D., and Fred L. Adair, M.D. University of Chicago Press, Chicago, Ill.

OBSTETRICS AND GYNECOLOGY. By the Departmental Staff of the University of Chicago and Other Contributors. Edited by Fred L. Adair, Mary Campau Ryerson, Professor and Chairman of the Department of Obstetrics and Gynecology, in the University of Chicago, etc. Volume I, 1,000 pages with 359 engravings and 14 plates. Volume II, 1,031 pages with 304 engravings and 10 plates. Lea & Febiger, Philadelphia, 1940.

GRUNDLAGEN DER SCHWANGERSCHAFTEN-ERNAEHRUNG. Von Dr. Med. G. Gaehtgens, Universitaets Frauenklinik zu Leipzig. 142 pages with 9 illustrations. Verlag von Theodor Steinkopff, Dresden, 1940.

IL CICLO SESSUALE DELLE MADRI DELLE FAMIGLIE NUMEROSE. A cura di Corrado Gini e Pia de Orchi. Comitato Italiano per lo studio dei Problemi della Popolazione. Roma, 1939.

MANAGEMENT OF OBSTETRIC DIFFICULTIES. By Paul Titus, obstetrician and gynecologist to the St. Margaret Memorial Hospital, Pittsburgh, etc. Second edition, 868 pages, with 368 illustrations and 5 color plates. The C. V. Mosby Company, St. Louis, 1940.

SHOCK. Blood Studies as a Guide to Therapy. By John Scudder, M.D. From the Surgical Pathology Laboratory of the College of Physicians and Surgeons, Columbia University, and the Department of Surgery, Presbyterian Hospital, New York. 315 pages, with 55 illustrations and five plates. J. B. Lippincott Company, Philadelphia, 1940.

ROSTER OF AMERICAN OBSTETRICAL AND GYNECOLOGICAL SOCIETIES*

(Appears in January, April, July, October)

American Gynecological Society. *President,* F. L. Adair. *Secretary,* Richard W. TeLinde, 11 East Chase Street, Baltimore, Md. Next meeting, June 17-19, 1940, at the Seignory Club, Quebec, Canada.

American Association of Obstetricians, Gynecologists and Abdominal Surgeons. *President,* James R. McCord. *Secretary,* James R. Bloss, 418 11th Street, Huntington, W. Va. Next meeting, September 19 to 21, 1940, Excelsior Springs, Mo.

Central Association of Obstetricians and Gynecologists. *President,* Jennings C. Litzenberg, Minneapolis, Minn. *Secretary-Treasurer,* W. F. Mengert, Iowa City, Iowa. Annual meeting, Indianapolis, Ind., October, 1940.

South Atlantic Association of Obstetricians and Gynecologists. *President,* M. P. Rucker, Richmond, Va. *Secretary,* Robert A. Ross, Durham, N. C. Next meeting, February 7 and 8, 1941, Jacksonville, Fla.

A. M. A. Section on Obstetrics and Gynecology. *Chairman,* Ludwig A. Emge. *Secretary,* Norman F. Miller, Ann Arbor, Mich. Next meeting, June 10 to 14, 1940, New York City.

New York Obstetrical Society. *President,* William S. Smith. *Secretary,* Henry T. Burns, 162 East 71st St., New York City. Second Tuesday, from October to May, Yale Club.

Obstetrical Society of Philadelphia. *President,* Thomas B. Lee. *Secretary,* John C. Hirst, 500 North 20th St., Philadelphia, Pa. First Thursday, from October to May.

Chicago Gynecological Society. *President,* Julius E. Lackner. *Secretary,* Edward Allen, 55 East Washington St., Chicago, Ill. Third Friday, from October to June, Hotel Knickerbocker.

Brooklyn Gynecological Society. *President,* Goerge H. Davis. *Secretary,* Bruce A. Harris, 175 Clinton St., Brooklyn, N. Y. First Friday, from October to May, Kings County Medical Society, 1313 Bedford Avenue.

Baltimore Obstetrical and Gynecological Society. *President,* J. J. Eastman. *Secretary,* Frank K. Morris, 11 East Chase St., Baltimore, Md. Meets quarterly at Maryland Chirurgical Faculty Building.

Cincinnati Obstetrical Society. *President,* E. W. Enz. *Secretary,* Edward Friedman, 19 West Seventh St., Cincinnati, O. Third Thursday of each month.

Louisville Obstetrical and Gynecological Society. *President,* Esther C. Wallner. *Secretary,* Samuel S. Gordon, 520 Heyburn Building, Louisville, Ky. Fourth Monday, from September to May, Brown Hotel.

Portland Society of Obstetrics and Gynecology. *President,* Howard Stearns. *Secretary,* William M. Wilson, 545 Medical Arts Bldg., Portland, Ore. Last Wednesday of each month.

Pittsburgh Obstetrical and Gynecological Society. *President,* S. A. Chalfant. *Secretary,* Dr. Joseph A. Hepp, 121 University Place, Pittsburgh, Pa. First Monday of October, December, April, and June.

Obstetrical Society of Boston. *President,* Raymond S. Titus. *Secretary,* Judson A. Smith, 262 Beacon St., Boston, Mass. Third Tuesday, October to March, Harvard Club.

*Changes, omissions, and corrections should be addressed to the Editor of the JOURNAL.

New England Obstetrical and Gynecological Society. *President,* Thomas Almy. *Secretary,* R. J. Heffernan, 475 Commonwealth Avenue, Boston, Mass. May and December.

Pacific Coast Obstetrical and Gynecological Society. *President,* Alice F. Maxwell. *President-Elect,* John Vruwink. Meetings held in late fall or early winter, rotating in the larger cities of the Pacific Coast. Next meeting, San Francisco, Calif., Nov. 6 to 9, 1940.

Washington Gynecological Society. *President,* H. P. Ramsey. *Secretary,* James R. Costello, 900 17th Street, N. W., Washington, D. C. Fourth Saturday, October to May.

New Orleans Obstetrical and Gynecological Society. *President,* H. C. McGee. *Secretary,* H. W. Reddock, 1430 Tulane Avenue, New Orleans, La. Meetings held every other month.

St. Louis Gynecological Society. *President,* Percy H. Swahlen. *Secretary,* Joseph A. Hardy, Jr., 3720 Washington Blvd. Second Thursday, October, December, February, and April.

San Francisco Gynecological Society. *President,* T. Floyd Bell. *Secretary,* R. Glenn Craig, 490 Post Street, San Francisco, Calif. Regular meetings held second Friday in month, University Club, San Francisco, or Claremont Country Club, Oakland, Calif.

Texas Association of Obstetricians and Gynecologists. *President,* H. Reid Robinson, Galveston, Texas. *Secretary-Treasurer,* J. McIver, 714 Medical Arts Building, Dallas, Texas. Next meeting, Marlin, Texas, October, 1940.

Item

American Board of Obstetrics and Gynecology

The general oral and pathological examinations (Part II) for all candidates (Groups A and B) will be conducted at Atlantic City, N. J., from Friday, June 7, through Monday, June 10, 1940, prior to the opening of the annual meeting of the American Medical Association in New York City on Wednesday, June 12, 1940. Formal notice of the exact time and place of the examination will be forwarded to each candidate several weeks in advance of the examination dates. Group A candidates will be examined on June 7 and 8, and Group B candidates on June 9 and 10.

Candidates for *reexamination* in Part II must make written application to the Secretary's Office *before April 15.*

The annual dinner of the Board will be held in New York City on Wednesday evening, June 12, 1940, at the Hotel McAlpin. Diplomates certified at the preceding days' examinations will be introduced personally, and there will be several speakers. All Diplomates of the Board, and others interested in the work of the Board, are cordially invited to attend this dinner. Tickets at $3.50 each may be obtained from Dr. Joseph L. Baer, chairman, 104 S. Michigan Avenue, Chicago, Illinois, or at the registration desk during the examinations.

For further information and application blanks, address Dr. Paul Titus, Secretary, 1015 Highland Building, Pittsburgh (6), Pennsylvania.